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Energy
A Continuing
Bibliography
with Indexes

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ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

STAR (N-10000 Series)	N83-16275 - N83-23266
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ENERGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

Issue 38

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between April 1 and June 30, 1983 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

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INTRODUCTION

This issue of *Energy: A Continuing Bibliography with Indexes* (NASA SP-7043(38)) lists 1367 reports, journal articles, and other documents announced between April 1, 1983 and June 30, 1983 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of this continuing bibliography was published in May 1974.

The coverage includes regional, national and international energy systems; research and development on fuels and other sources of energy; energy conversion, transport, transmission, distribution and storage, with special emphasis on use of hydrogen and of solar energy. Also included are methods of locating or using new energy resources. Of special interest is energy for heating, lighting, for powering aircraft, surface vehicles, or other machinery.

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract. The entries are arranged in eight major categories, with *IAA Entries* preceding *STAR Entries* in each category. The citation, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR* including the original accession numbers from the respective announcement journals. This procedure, which saves time and money accounts for the slight variation in citation appearances.

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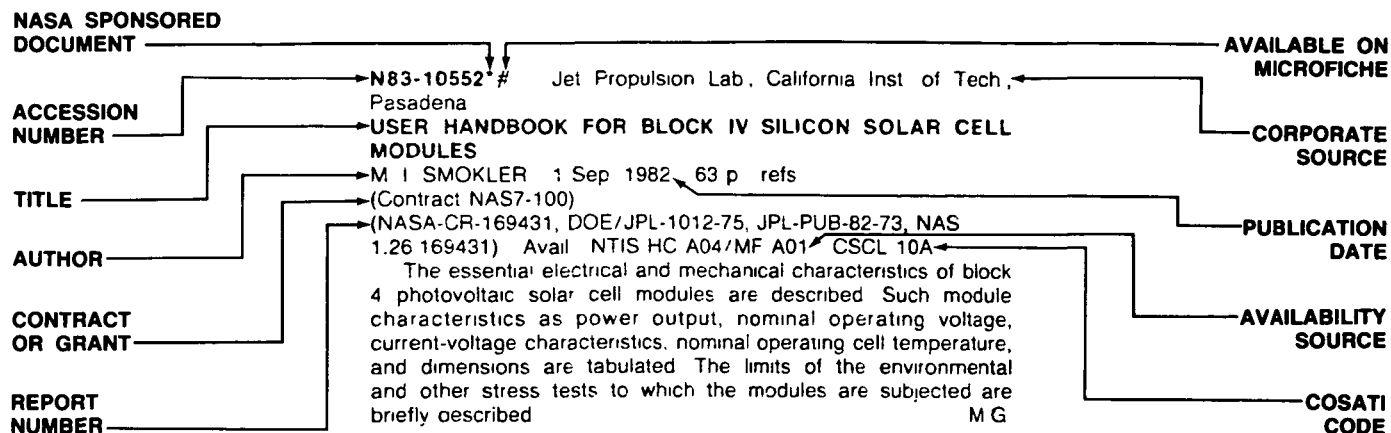
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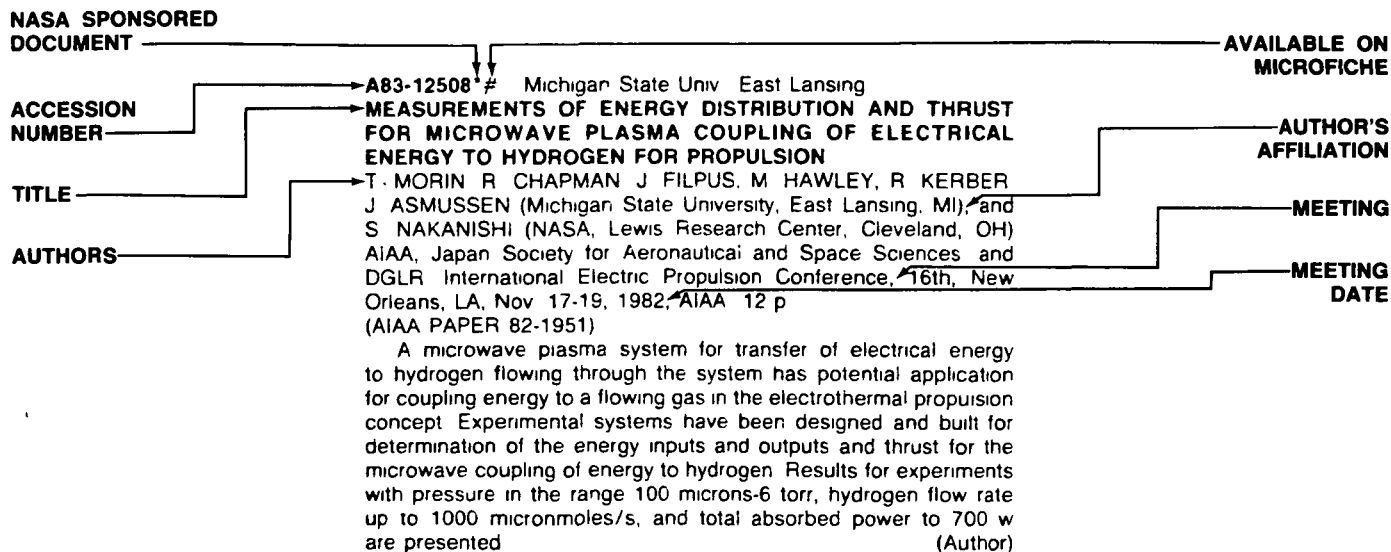
TABLE OF CONTENTS

	Page
Category 01 Energy Policies and Energy Systems Analysis	1
Includes energy requirements, energy conservation, and environmental impacts of energy systems.	
Category 02 Solar Energy	37
Includes solar collectors, solar cells, solar heating and cooling systems, and solar generators.	
Category 03 Hydrogen	85
Includes hydrogen production, storage, and distribution.	
Category 04 Fuels and Other Sources of Energy	90
Includes fossil fuels, nuclear fuels, geothermal, ocean thermal, tidal, and wind energy, and biomass energy production.	
Category 05 Energy Conversion	149
Includes thermomechanical, thermoelectric, geothermal, ocean thermal, and wind energy conversion. Also includes nuclear reactors, magneto-hydrodynamic generators, and fuel cells.	
Category 06 Energy Transport, Transmission, and Distribution	184
Includes transport of fuels by pipelines, tubes, etc., microwave power transmission, and superconducting power transmission.	
Category 07 Energy Storage	188
Includes flywheels, heat storage, underground air storage, compressed air, and storage batteries.	
Category 08 General	199
Subject Index	A-1
Personal Author Index	B-1
Corporate Source Index	C-1
Contract Number Index	D-1
Report / Accession Number Index	E-1
Accession Number Index	F-1

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A Listing of Energy Bibliographies Contained in This Publication:

- | | | |
|---|------|-----------|
| 1. Amorphous silicon bibliography update - Introduction | p41 | A83-22915 |
| 2. Energygrams: Brief descriptions of energy technology | p199 | N83-16891 |
| 3. Energygrams: Brief descriptions of energy technology | p199 | N83-16892 |
| 4. Overview of existing residential energy-efficiency rating systems
and measuring tools | p20 | N83-19289 |
| 5. Waste lubricating oil: An annotated review, 1982 revision | p30 | N83-21156 |

JULY 1983

01

ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

Includes energy requirements, energy conservation, and environmental impacts of energy systems.

A83-19661

THE MCA METHOD, A FLIGHT TEST TECHNIQUE TO DETERMINE THE THRUST OF JET AIRCRAFT IN FLIGHT [DIE M.C.A.-METHODE, EIN FLUGVERSUCHSTECHNISCHES VERFAHREN ZUR ERMITTLUNG DES SCHUBES VON STRAHFLUGZEUGEN IM FLUGE]

R ROSENBERG and G. SCHUCH (Bundesamt fuer Wehrtechnik und Beschaffung, Manching, West Germany) Zeitschrift fuer Flugwissenschaften und Weltraumforschung, vol 6, Nov-Dec. 1982, p. 383-390. In German.

A proposal by Casetti (1978) which uses the principle of conservation of energy to derive a relationship for thrust which includes the overall efficiency of the aircraft as a variable, is fully developed. The overall efficiency is the key to a technique (MCA or mass consumption acceleration) which allows the thrust in flight to be determined. Using the technique, relevant thrust data for various types of fighter plane lately introduced into the German air force are ascertained. The results show a scatter of about five percent

C D

A83-20224

THE INFLUENCE OF LARGE-SCALE ADVECTION ON THE VERTICAL DISTRIBUTION OF STRATOSPHERIC SOURCE GASES IN 44 DEGREE AND 41 DEGREE NORTH

M SCHMIDT (Max-Planck-Institut fuer Aeronomie, Katlenburg, West Germany) Journal of Geophysical Research, vol. 87, Dec. 20, 1982, p. 11239-11246 refs

Correlations between deviations from mean profiles of CH₄ and N₂O vertical distributions in the stratosphere and air mass trajectories in the 100 mbar and 30 mbar level are discussed. The profiles were taken from results of 11 balloon flights over France and 3 flights over Laramie/Wyoming during 1976-1980. The deviations in the profiles appear to depend on the origin of the air masses. Compared with the results from the lower stratosphere, the conditions in the middle stratosphere between 20 and 36 km height are more complex and seasonally dependent. Some possible explanations with respect to the general circulation in the stratosphere and troposphere are given.

(Author)

A83-22344

THE ORIGIN AND NATURE OF 'PROMPT' NITRIC OXIDE IN FLAMES

A N. HAYHURST and I. M. VINCE (Sheffield University, Sheffield, England) Combustion and Flame, vol. 50, Feb. 1983, p. 41-57. refs

The measured quantities of 'prompt' nitric oxide (NO) produced during combustion are reported. The experimental procedures are discussed together with the measured values, with consideration given to the effects of such variables as equivalence ratio, residence time, concentration of hydrocarbons, equilibrium

concentration of NO, flame temperature and hydrocarbon additives like CH₄, C₂H₂, CH₃C₂H, C₃H₈. The amount of prompt NO produced during combustion is proportional to the concentration of carbon atoms and to the concentration of nitrogen present in the system. The insensitivity to temperature and stoichiometry of the quantity of NO produced, coupled with its sensitivity to the concentration of carbon atoms and to nitrogen, provides a simple rule for the prediction of the quantity of prompt NO in many flames. The influence of hydrocarbon pyrolysis on the quantity of prompt NO and the subsequent attack of the fractured hydrocarbons on nitrogen are discussed.

M I I

A83-23239

PW 4000 - A RADICALLY NEW JET ENGINE BEING DEVELOPED IN THE USA

Aircraft Engineering, vol. 55, Feb. 1983, p. 2-5

The design features and performance capabilities of the PW 4000-series turbofan for wide body airliners are presented, using as a point of reference the characteristics of the JT9D family of turbofans which the present state-of-the-art design will supplant after certification in 1986. Fuel consumption is expected to be reduced by 7%, and maintenance and repair will be significantly simplified by the use of 54% fewer parts. A unique feature of the PW 4000 is the 'Thermatic' high pressure compressor rotor, which under the appropriate conditions employs temperature increases to automatically expand and thereby tighten blade tip and seal clearances. Maximum rotor speed for the PW 4000 is 27% faster than in the JT9D, yielding greater efficiency. A completely digital engine control system is employed which can precisely manage thrust levels for maximum efficiency.

O.C

A83-23437

A SYSTEM OF CRITERIA FOR EVALUATING THE ENERGY EFFICIENCY OF AN ENGINE AT THE STATE OF TECHNICAL PROPOSALS [SISTEMA KRITERIEV ZAVIAZKI I OTSENKI ENERGETICHESKOI EFFEKTIVNOSTI DVIGATELIA NA STADII TEKHNICHESKIKH PREDLOZHENII]

V A. SGILEVSKII Aviatsonnaia Tekhnika, no. 3, 1982, p. 67-74. In Russian.

Based on the concept of the energy efficiency of an engine in an aircraft system, complex dimensionless parameters are proposed for use at early stages of aircraft design for evaluating the power requirements of an aircraft and power consumption during the execution of various missions. The system of criteria proposed here is used in a high-level computer-aided engine design system at the stage of preliminary design.

V.L.

A83-24041#

GROUND CONTAMINATION BY FUEL JETTISONED FROM AIRCRAFT IN FLIGHT

H J. CLEWELL, III (USAF, Engineering and Services Center, Tyndall AFB, FL) Journal of Aircraft, vol. 20, Apr 1983, p. 382-384 refs

Increased ground contamination hazards due to in-flight jettisoning of JP-8 jet fuel, which is replacing JP-4 in USAF NATO jet aircraft, are assessed. Fuel jettisoning is performed when either an in-flight emergency or operational requirements to ensure a safe landing call for the action. A computer model was developed to compare the evaporation and free-fall of fuel droplets in the atmosphere. The model described droplet fall and successive

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

breakups, i.e., reductions in mass, during the downward journey to either contact with the ground or complete evaporation. The amount of fuel that normally reaches the ground was found to be the same for both fuels, except at higher temperatures, when more of the new JP-8 fuel reaches the ground. The droplets at the ground have a different chemical composition than that present during jettisoning due to loss of the volatile components. It is suggested that jettisoning be confined wherever possible to above 1500 m altitude or higher M.S.K.

A83-24251 UNCERTAINTIES OF PREDICTIONS OF FUTURE ATMOSPHERIC CO₂ CONCENTRATIONS

H. OESCHGER and M. HEIMANN (Bern, Universitaet, Berne, Switzerland) *Journal of Geophysical Research*, vol 88, Feb 20, 1983, p. 1258-1262 refs

The basic information for predictions is the airborne fraction observed over the past 20 years. Depending on the assumptions made, the effective airborne fraction, defined as the ratio of the CO₂ increase from fossil fuel CO₂ alone to the integrated CO₂ production, might be as low as 0.38 or as high as 0.72. This is to be compared with the apparent airborne fraction of 0.55. It is noted that the effective airborne fraction derived from carbon cycle models, which consider only the CO₂ uptake by the ocean, is in the range 0.60-0.70. A value as low as 0.40 is therefore considered highly improbable. It is believed that a high biospheric anthropogenic CO₂ input must have been accompanied by a high CO₂ fertilization effect. However, model considerations are not in contradiction with a high biospheric input with the maximum production before 1958, this would also imply low preindustrial CO₂ concentrations in the range 270-280 ppm, as reported recently C.R.

A83-24252 FEEDBACK MECHANISMS IN THE CLIMATE SYSTEM AFFECTING FUTURE LEVELS OF CARBON DIOXIDE

W. W. KELLOGG (National Center for Atmospheric Research, Boulder, CO) (WMO, International Council of Scientific Unions, and United Nations, Scientific Conference on Analysis and Interpretation of Atmospheric Data, Berne, Switzerland, Sept 14-18, 1981.) *Journal of Geophysical Research*, vol 88, Feb. 20, 1983, p. 1263-1269. refs

It is noted that the rate of increase in the concentration of atmospheric carbon dioxide depends on the consumption of fossil fuels (the principal source of 'new' carbon dioxide) and the natural sinks for this trace constituent, mainly the oceans and the biosphere. It is now fairly well established that the biosphere cannot be an important source, as has been claimed. The rate at which these sinks operate depends on several factors determined by the state of the climate system, and they will therefore presumably change as the greenhouse effect of increasing carbon dioxide warms the earth. Five specific feedback loops are treated, two of which are positive (amplifying the rate of increase), two weakly negative (damping the rate of increase), and one that is indeterminate but is probably positive. It is concluded that it is advisable to be prepared for the possibility that carbon dioxide may increase faster than predicted by models based on the current or past state of the climate system C.R.

A83-24255# EXPONENTIAL GROWTH AND ATMOSPHERIC CARBON DIOXIDE

J. A. LAURMANN (Gas Research Institute, Chicago, IL) and R. M. ROTT (Oak Ridge Associated Universities, Inc., Oak Ridge, TN) *Journal of Geophysical Research*, vol 88, Feb. 20, 1983, p. 1295-1299. refs

The adequacy of the assumptions required to project atmospheric CO₂ concentrations in time frames of practical importance is surveyed. Relevant issues are the form assumed for future fossil fuel release, carbon cycle approximations, and the implications of revisions in fossil fuel patterns required to maintain atmospheric CO₂ levels below a chosen threshold. It is found that, in general, with a judiciously selected exponential fossil

fuel release rate and with a constant airborne fraction, atmospheric CO₂ growth over the next 50 years can be estimated using essentially surprise-free scenarios. Resource depletion effects must be included for projections beyond approximately 50 years, and on this time frame the constant airborne fraction approximation needs to be questioned as well, especially in later years when the fossil fuel use begins to taper off. For projections for over 100 years, both energy demand scenarios and available carbon cycle models are so riddled with uncertainties that atmospheric CO₂ levels derived from them are not much better than guesses C.R.

A83-24256# DISTRIBUTION OF AND CHANGES IN INDUSTRIAL CARBON DIOXIDE PRODUCTION

R. M. ROTT (Oak Ridge Associated Universities, Inc., Oak Ridge, TN) *Journal of Geophysical Research*, vol 88, Feb 20, 1983, p. 1301-1308. refs

It is pointed out that the burning of fossil fuels is believed to be the principal source of the observed increase in the concentration of carbon dioxide in the atmosphere. Earlier published data on the annual amounts of carbon released into the atmosphere during the years 1950-1978 are revised, and a record through 1980 is given. A latitudinal distribution of the fossil fuel source is presented as an aid in explaining the differences in the observed CO₂ concentrations at a number of stations. Observations in the atmosphere reveal that the Northern Hemisphere CO₂ concentration is increasing more rapidly than the Southern Hemisphere concentration and that the most rapid increase is at 50-60 deg N latitude. The greatest seasonal variation is also in this latitude band. The fossil fuel sources of CO₂ are also documented and updated. It is shown that a change in the rate of increase in annual CO₂ emissions occurred in 1973, and an attempt is made to delineate the regional distribution of this source of CO₂ C.R.

A83-24279# THE SEASONAL VARIATION OF THE ATMOSPHERIC SO₂ TO SO₄ CONVERSION RATE

J. F. MEAGHER, E. M. BAILEY (Tennessee Valley Authority, Muscle Shoals, AL), and M. LURIA (Jerusalem, Hebrew University, Jerusalem, Israel) *Journal of Geophysical Research*, vol 88, Feb 20, 1983, p. 1525-1527. Research supported by the Tennessee Valley Authority, U.S. Environmental Protection Agency refs (Contract EPA-81-DX-0511)

The dependence of the nonaqueous phase SO₂ oxidation rate on various meteorological parameters is investigated using data collected during eight separate field studies conducted at four coal-fired power plants. Results show that the nonaqueous phase atmospheric SO₂ oxidation rate exhibits a marked seasonal dependence. The average rates calculated for the eight field studies are found to vary from 0.0015/h for the winter low to 0.0130/h for the summer high. In addition, model calculations utilizing photochemical oxidation are shown to predict a similar seasonal variation in SO₂ oxidation N.B.

A83-24361*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va STRUCTURES AND MECHANISMS - STREAMLINING FOR FUEL ECONOMY

M. F. CARD (NASA, Langley Research Center, Hampton, VA) *Astronautics and Aeronautics*, vol 21, Mar. 1983, p. 66-68

The design of prospective NASA space station components which inherently possess the means for structural growth without compromising initial system characteristics is considered. In structural design terms, space station growth can be achieved by increasing design safety factors, introducing dynamic isolators to prevent loads from reaching the initial components, or preplanning the refurbishment of the original structure with stronger elements. Design tradeoffs will be based on the definition of on-orbit loads, including docking and maneuvering, whose derived load spectra will allow the estimation of fatigue life. Improvements must be

made in structural materials selection in order to reduce contamination, slow degradation, and extend the life of coatings. To minimize on-orbit maintenance, long service life lubrication systems with advanced sealing devices must be developed.

O C

A83-24828**AN APPROACH TO HELICOPTER POWER SELECTION**

A. NEUBURGER (Pratt and Whitney Aircraft of Canada, Ltd., Advanced Design Dept., Longneuil, Quebec, Canada) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint. 15 p.

A preliminary design method is developed to determine engine ratings for take-off and emergency power which satisfy two arbitrary flight design requirements for multi-engined helicopters. The method utilizes the engine's potential for higher emergency rating which is greatly affected by the required test time at that rating. It is shown that the ratio of emergency to take-off power can be increased from 1.20 to 1.33 if the emergency rating's test time is reduced from 2 hours to 1/4 hour for one 150 hour endurance test, which can result in improved emission fuel efficiency (4%) and reduced engine operating cost (2.5%). In addition, it is found that the engine operating cost for a three-engine installation is higher than for a two-engine installation, despite superior fuel efficiency. It is concluded that this method can be used to study the impact of flight design requirements on engine economics and fuel efficiency.

N B

A83-25575**MIAMI INTERNATIONAL CONFERENCE ON ALTERNATIVE ENERGY SOURCES, 5TH, MIAMI BEACH, FL, DECEMBER 13-15, 1982, PROCEEDINGS OF CONDENSED PAPERS**

T. N. VEZIROGLU, (ED.) (Miami, University, Coral Gables, FL) Conference sponsored by DARPA. Coral Gables, FL, University of Miami, 1982. 807 p.

The rate of progress and state of the art in various alternative energy systems is assessed in a series of extended abstracts. Renewable energy sources such as hydroelectricity, solar heating, wind power, solar cells, bioconversion, OTEC, and alcohol are discussed. Attention is given to thermal energy storage, solar stills, hydrogen fuel systems, and the economics of wind power. Fusion, breeder, and fission reactors are considered, as are geothermal energy extraction, wave energy systems, the CO₂ effects on the atmosphere caused by burning fuels, and conservation and waste utilization technologies. Finally, energy education programs and national energy policy are investigated.

D.H K

A83-26641#**PROPAGATION AT 10 MICRONS THROUGH SMOKE PRODUCED BY ATMOSPHERIC COMBUSTION OF DIESEL FUEL**

C. W. BRUCE (U.S. Army, Atmospheric Sciences Laboratory, White Sands Missile Range, NM) and N. M. RICHARDSON (New Mexico State University, University Park, NM) Applied Optics, vol 22, Apr 1, 1983, p 1051-1055. refs

Absorption and extinction due to the smoke produced by the atmospheric combustion of diesel fuel have been measured using a CO₂ laser spectrophotometer at a wavelength of 10.6 microns. The absorption coefficient normalized to the aerosol mass density is 0.84 ± 0.0076 sq m/g, and the total scattering coefficient (the difference between the extinction and absorption values) normalized in the same way is 0.15 ± 0.014 sq m/g. The largely fibrous aerosol was found to be 80% carbon, with most of the remainder consisting of hydrocarbons which are comparatively transparent at 10.6 microns and physically resemble the unburned fuel. The normalized coefficients of this study approximate those of diesel automobile effluents. This is not surprising since the aerosol composition and morphology appear to be similar.

(Author)

A83-27159**THE RELATIVE ATTRACTIVENESS OF ELECTRIC AND HYBRID PASSENGER CARS**

A. F. BURKE (General Electric Co., Fairfield, CT) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p. 284-289. refs

The U.S. Department of Energy has funded programs for the development of both electric and hybrid (heat engine/electric) test vehicles. The present investigation is concerned with an evaluation of the relative attractiveness of the two types of vehicles, taking into account total weight, selling price, operating cost, gasoline savings, and total energy usage. It is found that in all aspects considered the hybrid vehicles are more attractive than all-electric vehicles having the same power-to-weight ratio and using the same batteries. The relative advantages of the hybrid vehicle increase significantly as the power-to-weight ratio is increased.

G.R.

A83-27160**CONTEMPORARY ELECTRIC VEHICLE TESTING AND EVALUATION**

J. MADER (Electric Power Research Institute, Palo Alto, CA), F. KLEIN (Gesellschaft fuer elektrischen Strassenverkehr mbH, Duesseldorf, West Germany), and O. BEVILACQUA (Bevilacqua-Knight, Inc., Oakland, CA) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p. 290-295.

With respect to the vehicle user, there exists currently both considerable interest and general uncertainty concerning the operating and performance characteristics of contemporary electric vehicles (EVs). In connection with this situation, an investigation was initiated with the objective to develop an EV testing activity which provides information that can be used in evaluating the suitability of available EVs for typical commercial fleet applications. EV performance tests are discussed, taking into account a preliminary vehicle inspection, track tests, road tests, and dynamometer tests. Test results considered demonstrate that EV driving range and ac energy consumption can vary dramatically for the same vehicle under different operating situations. It is recommended that range and ac energy consumption should be examined in conjunction with the dc energy consumption rates.

G R

A83-27207**TWENTY YEARS OF EXPERIENCE WITH ORGANIC RANKINE CYCLE TURBINES - THEIR APPLICABILITY AND USE IN ENERGY CONSERVATION AND ALTERNATIVE ENERGY SYSTEMS**

L. Y. BRONICKI (Ormat Turbines, Ltd., Yaune, Israel) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1118-1121.

A83-27211**METAL HYDRIDE HEAT PUMP**

D. A. ROHY, T. A. ARGABRIGHT, and G. W. WADE (Solar Turbines, Inc., San Diego, CA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1160-1165. Research supported by the U.S. Department of Energy.

The materials, design features, and projected performance of a metal hydride heat pump are explored. Two alloys with hydrogen absorption/desorption (endothermic) properties are included, with the hydrogen being driven back and forth between the two and not consumed. Heat rejected by absorption is rejected by the cold side to the air. When the cold side is full, the pressure differential is reversed and the hydrogen returns to the warm

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

section. Heat in a coolant is used at the cold side to initiate dissociation from the hydride. A test unit providing 35.7 kWt of cooling capacity with a source temperature of 200 F and a refrigerated cycle of 40-50 F was built using LaNi5 for the warm side and MMNi4 5FeO.85 on the cold side. Full power was reached in 3-6 min and performance coefficients near 5 were attained. Waste heat, solar and fossil fuel heat sources were identified as viable power supply candidates for refrigeration units requiring 0.5-10.0 tons of capacity. M.S.K.

A83-27225

R AND D OF ENERGY SAVING AND NEW ENERGY UTILIZATION IN JAPANESE MARINE ENGINEERING

N. ISSHIKI (Tokyo Institute of Technology, Mitaka, Tokyo, Japan), H. TAMAKI, Y. MURAYAMA, and S. TOKUDA (Ship Research Institute, Tokyo, Japan). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982, Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1427-1432.

Energy saving measures being studied and implemented in Japan to reduce marine diesel fuel consumption are described. Lower ship speeds, bulb bows, better surface paint, a reaction ladder, low speed diesel engines with long stroke cylinders and superchargers are being tried. Large, low speed, controllable pitch propellers, digital engine control, and waste heat recovery with Rankine cycle generators are other methods under investigation. Blade cooling and reheating are being introduced, and a set of computer controlled maneuverable metal sails undergoing sea tests on a commercial tanker as a fuel saving technique have displayed a 20% fuel savings in tests. A windmill is under design for ship propulsion, involving several vertical airfoils revolving around a vertical axis of rotation. Direct connection to a propeller is being considered, noting that operations to windward would be possible. M.S.K.

A83-27867

THE ENVIRONMENTAL IMPACT OF THE USE OF LARGE WIND TURBINES

P. T. MANNING (Central Electricity Generating Board, Environment Section, London, England). Wind Engineering, vol. 7, no. 1, 1983, p. 1-11. refs.

The existing data base on the environmental impact of large wind energy conversion systems (WECS) is explored. The maximum blade throw distance has been calculated at 850 m, with a 5% probability of more than 300 m. Good design and inspection procedures reduce the risk. Ice throw can be prevented by aircraft deicing techniques, but detectors are still necessary. TV interference is ameliorated by the use of composite blades and directional antennas, by relocating the nearest transmission or relay station, or by introduction of cable TV. Microwave transmission effects can be avoided by careful siting of WECS in a favorable line of sight whenever within 1 km of a transmitter. Visual impact studies have produced few adverse opinions. Noise has not proved an intractable problem, although 30 dB levels have been exceeded 2100 m downwind of the Mod 2 WECS. Further studies are necessary on the effects of heightened ground turbulence produced by large WECS. It is expected that few birds will be harmed by slowly rotating blades in the birds' natural domain, a projection confirmed by sporadic studies. Finally, aircraft collisions are regarded as unlikely and actual land use, mostly confined to rural areas, is minimal. M.S.K.

A83-28765

A PHYSIOLOGICAL AND HYGIENIC EVALUATION OF THE WORK REGIME OF OPERATORS WHO ARE WORKING IN CURRENT ENERGY PRODUCTION IN KIRGHIZIA [FIZIOLOGO-GIGIENICHESKAIA OTSENKA REZHIMA TRUDA OPERATOROV, OBSLUZHIVAIUSHCHIKH SOVREMENNYE ENERGETICHESKIE PROIZVODSTVA KIRGIZII]

B. S. MAMBETALIEV, A. D. DZHAILOBAEV, A. B. BOTOMBEKOVA, O. T. KASYMOV, and A. M. KYDYRALIEVA (Kirgizskii Gosudarstvennyi Meditsinskii Institut, Frunze, Kirgiz SSR). Zdravookhranenie Kirgizii, Sept.-Oct. 1982, p. 7-12. In Russian.

A83-29393#

ENERGY CONSERVATION IN AIR TRANSPORTATION - THE CANADIAN AIR TRAFFIC CONTROL EFFORT

R. E. CHAFE (Transport Canada, Ottawa, Canada). Canadian Aeronautics and Space Journal (ISSN 0008-2821), vol. 28, Dec. 1982, p. 339-345.

Air Traffic Services, an element of the Canadian Air Transport Administration, has taken steps to satisfy requirements for a service which will yield energy and cost efficiency improvements for prospective users. Considerations influencing the formulation of policy have included data on the North Atlantic airspace at and above Flight Level 270, together with its transition area over eastern Canada, the demands of military airspace, standard profile aircraft descents to minimize radar vectoring requirements, the possibilities for the automation of air traffic control, and an air traffic flow management program currently under development. O.C.

N83-16329*#

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.

AN ON-BOARD NEAR-OPTIMAL CLIMB-DASH ENERGY MANAGEMENT Interim Report

A. R. WESTON, E. M. CLIFF, and H. J. KELLEY. Dec. 1982. 122 p. refs.

(Contract NAG1-203)

(NASA-CR-169755; NAS 1.26.169755) Avail. NTIS HC A06/MF A01. CSCL 01C.

On-board real time flight control is studied in order to develop algorithms which are simple enough to be used in practice, for a variety of missions involving three dimensional flight. The intercept mission in symmetric flight is emphasized. Extensive computation is required on the ground prior to the mission but the ensuing on-board exploitation is extremely simple. The scheme takes advantage of the boundary layer structure common in singular perturbations, arising with the multiple time scales appropriate to aircraft dynamics. Energy modelling of aircraft is used as the starting point for the analysis. In the symmetric case, a nominal path is generated which falls into the dash or cruise state. Feedback coefficients are found as functions of the remaining energy to go (dash energy less current energy) along the nominal path. S.L.

N83-16341*#

General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.

ENERGY EFFICIENT ENGINE: FAN TEST HARDWARE DETAILED DESIGN REPORT

T. J. SULLIVAN. Oct. 1980. 146 p. refs.

(Contract NAS3-20643)

(NASA-CR-165148; NAS 1.26.165148; R80-AEG-417) Avail. NTIS HC A07/MF A01. CSCL 21E.

A single stage fan and quarter stage booster were designed for the energy efficient engine. The fan has an inlet radius ratio of 0.342 and a specific flow rate of 208.9 Kg/S sq m (42.8 lbm/sec sq ft). The fan rotor has 32 medium aspect ratio (2.597) titanium blades with a partspan shroud at 55% blade height. The design corrected fan tip speed is 411.5 M/S (1350 ft/sec). The quarter stage island splits the total fan flow with approximately 22% of the flow being supercharged by the quarter stage rotor. The fan bypass ratio is 6.8. The core flow total pressure ratio is 1.67 and the fan bypass pressure ratio is 1.65. The design details of the fan and booster blading, and the fan frame and static structure for the fan configuration are presented. S.L.

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-16569# Brookhaven National Lab, Upton, N Y
DESIGN AND CONSTRUCTION OF A DEMONSTRATION RESIDENCE UTILIZING NATURAL THERMAL STORAGE
 R F JONES and H T GHAFARI 1981 8 p refs Presented at the Solar World Forum, Brighton, England, 23-28 Aug 1981 (Contract DE-AC02-76CH-00016) (DE82-005508; BNL-30267, CONF-810865-7) Avail NTIS HC A02/MF A01

The Brookhaven House is an energy conserving residence which demonstrates how thermal mass combined with solar energy can be used to reduce heating costs in a conventional single family house. The purpose of the project was to develop a prototypical house design that could result in immediate energy savings by being an acceptable, attractive design to developers, builders, and home buyers. Investigations were limited to only materials and methods of construction that were considered presently available and of Natural Thermal Storage design. Natural thermal storage is simply the heat storage obtained through architectural application of massive building materials integrated into the living space and structure of a residence. It has been concluded that relatively thin mass walls of masonry directly irradiated through a multiglazed south facing aperture can significantly reduce annual heating requirements. DOE

N83-16653# General Electric Co, Schenectady, N Y
STOCHASTIC METHODS FOR ANALYSIS OF POWER FLOW IN ELECTRIC NETWORKS
 Washington DOE Sep 1982 46 p refs (Contract DE-AC01-78ET-29299) (DE83-000445; DOE/ET-29299-1) Avail NTIS HC A03/MF A01

The modeling and effects of probabilistic behavior on steady state power system operation were analyzed. A solution to the steady state network flow equations which adhere both to Kirchhoff's Laws and probabilistic laws, using either combinatorial or functional approximation techniques was obtained. The development of sound techniques for producing meaningful data to serve as input is examined. Electric demand modeling, equipment failure analysis, and algorithm development are investigated. Two major development areas are described: a decomposition of stochastic processes which gives stationarity, ergodicity, and even normality, and a powerful surrogate probability approach using proportions of time which allows the calculation of joint events from one dimensional probability spaces. DOE

N83-16655# Bevilacqua (O M) and Associates, Oakland, Calif
ELECTRIC VEHICLES IN ELECTRIC UTILITIES: A NATIONAL SURVEY Final Report
 Nov. 1981 71 p refs Sponsored by DOE and EPRI (DE82-901285; EPRI-EM-2131) Avail NTIS HC A04/MF A01

The vehicle fleet characteristics, actual and potential electric vehicle uses in those fleets, and information transfer needs of electric utilities were determined. A large national electric utility fleet and a small but significant potential for incorporation of electric vehicles are indicated. It is concluded that utilities need major improvements in access to information on electric vehicles. DOE

N83-16766# Corporate-Tech Planning, Inc., Waltham, Mass
THE ASSESSMENT OF VARIABLE VALVE TIMING OF INTERNAL COMBUSTION ENGINES FOR FUEL ECONOMY IMPROVEMENTS AND PRACTICABILITY Final Report, Aug. 1979 - Mar. 1981
 T TAYLOR, JR and R L KALIN Washington DOT Dec 1981 71 p refs (Contract DOT-HS-9-02110) (PB82-265364; DOT-HS-806-179) Avail NTIS HC A04/MF A01 CSDL 21G

The potential effects of variable valve timing for improving automotive engine fuel economy. Methods of implementation of valve timing control and their practicability were also assessed. It is concluded that savings of 5 to 10% over the normal drive cycle are probably realizable providing emphasis is directed towards optimizing valve timing schedules at low speeds under low loads as opposed to the current practice of wide open throttle. Methods

of implementation as reported from research programs and patent disclosures were also evaluated, categorized and assessed for manufacturing practicability. GRA

N83-16777# Sandia Labs, Albuquerque, N. Mex
INTERIM RELIABILITY EVALUATION PROGRAM (IREP)
 D D. CARLSON and J A MURPHY (Nuclear Regulatory Commission) 1981 4 p Presented at the Ann Meeting of the German Nucl Soc, Mannheim, West Germany, 4 May 1981 (Contract DE-AC04-76DP-00789) (DE82-004132; SAND-81-2625C, CONF-81051331) Avail NTIS HC A02/MF A01

The Interim Reliability Evaluation Program (IREP), sponsored by the Office of Nuclear Regulatory Research of the US Nuclear Regulatory Commission, is currently applying probabilistic risk analysis techniques to two PWR and two BWR type power plants. Emphasis was placed on the systems analysis portion of the risk assessment, as opposed to accident phenomenology or consequence analysis, since the identification of risk significant plant features was of primary interest. Traditional event tree/fault tree modeling was used for the analysis. However, the study involved a more thorough investigation of transient initiators and of support system faults than studies in the past and substantially improved techniques were used to quantify accident sequence frequencies. This study also attempted to quantify the potential for operator recovery actions in the course of each significant accident. DOE

N83-16870# Department of Energy, Washington, D C Office of Policy, Planning and Analysis
ENERGY PROJECTIONS TO THE YEAR 2000, JULY 1982 UPDATE
 Aug 1982 134 p refs (DE82-022523; DOE/PE-0029/1) Avail NTIS HC A07/MF A01

This report is an update of the energy projections and analysis presented in a document entitled Energy Projections to the Year 2000, a technical supplement to the National Energy Policy Plan (NEPP) submitted to Congress in July 1981. The format focuses on self-explanatory tables and figures with a minimum of accompanying text. DOE

N83-16876# Oak Ridge National Lab, Tenn. Environmental Sciences Div
USING PEAT FOR ENERGY: POTENTIAL ENVIRONMENTAL RESTRAINTS. OVERVIEW
 R M REED, L D VOORHEES, and P J MULHOLLAND 1981 37 p refs Presented at the 2nd Conf on Peat as an Alternative, Arlington, Va, 1 Dec 1981 (Contract W-7405-ENG-26) (DE82-005201; CONF-811217-1) Avail NTIS HC A03/MF A01

Serious consideration is being given to using peat as an energy resource in Minnesota, North Carolina, Florida, and some New England States. Potential environmental constraints for using peat as an energy resource are associated with disruption of important regional wetland ecosystems. Mining peatlands may significantly modify ground and surface water hydrology, degrade water quality in downstream receiving systems, contribute to the deterioration of local air quality, disrupt or eliminate plant and animal populations having specialized requirements and limited distributions, and destroy unique wetland ecosystems representing important scientific and educational resources. Careful selection of peatlands to be developed and application of appropriate mitigation and monitoring programs will be necessary to offset these impacts. DOE

N83-16884# Oak Ridge National Lab, Tenn. Energy Div
ENERGY AUDITS AT 48 HOSPITALS
 E HIRST 1981 6 p refs Presented at the 4th World Eng Congr, Atlanta, Ga, 12 Oct 1981 (Contract W-7405-ENG-26) (DE82-002814; CONF-811030-3) Avail NTIS HC A02/MF A01
 Staff at the Oak Ridge Associated Universities (ORAU) conducted energy audits at 48 hospitals in four states (New York,

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

Pennsylvania, Virginia, Tennessee) between 1978 and 1980. Staff at the Oak Ridge National Laboratory (ORNL) and ORAU developed and organized a computerized data base containing information from these audits. This paper describes the ORAU audit process; summarizes the data collected from these audits on hospital characteristics annual energy use, and the audit recommendations, and analyzes the audit data in terms of cost effectiveness, type of recommendations, and the relationship between potential energy saving and characteristics of the individual hospital DOE

N83-16885# California Univ., Berkeley. Lawrence Berkeley Lab Energy Efficient Buildings Program

EFFICIENT DAYLIGHTING IN THERMALLY CONTROLLED ENVIRONMENTS

E NEEMAN (Israel Inst of Technology, Haifa) and S SELKOWITZ Oct 1981 14 p refs Presented at the Intern Passive and Hybrid Cooling Conf, Miami Beach, Fla, 11-13 Nov 1981

(Contract W-7405-ENG-48)

(DE82-003045, LBL-13399; CONF-811109-4) Avail NTIS HC A02/MF A01

Many of the design considerations required to enable a design team to utilize daylight to the maximum possible extent are reviewed in order to reduce electric lighting loads and associated building energy consumption. Among steps that must be taken is a thorough analysis of all heating and cooling loads inside the building and the heat exchange through the building envelope. Data on local climate and sunshine availability must also be considered. Although the energy aspects have recently dominated design considerations, daylight's influence on human well being is gaining importance. In this respect, the variability of daylight, the quality of its spectral composition, the view out, and health effects are along the aspects that should be considered when determining an appropriate role for daylighting in energy efficient buildings. DOE

N83-16886# Oak Ridge National Lab, Tenn Energy Div
ANALYSIS OF ENERGY USE AT US INSTITUTIONAL BUILDINGS

E. HIRST, J. TRIMBLE, and R GOELITZ Nov 1981 41 p refs

(Contract W-7405-ENG-26)

(DE82-004670; ORNL/CON-78) Avail NTIS HC A03/MF A01

The Federal Institutional Conservation Program includes collection of energy use and energy related data from individual institutional buildings. Data were obtained from ten states (Massachusetts, New Hampshire, Vermont, New Jersey, Florida, Minnesota, Wisconsin, Texas, Kansas, and Oregon) on almost fifteen thousand schools, hospitals, local government buildings, and public care institutions. After the data were carefully examined, organized, and validated (i.e., outliers that might be errors were deleted), regression equations were developed for each of the four institutional building types. Because so many of the data elements were either missing or outliers, techniques were applied that allow incorporation of observations with missing data in the regression analysis. These equations explain annual energy use as functions of average energy price, floor area, year of construction, occupancy, air conditioning, primary heating fuel, owner, location, and building function. DOE

N83-16902# Ministry of Energy, Wellington (New Zealand).
ENERGY PLAN, 1981

1981 86 p

(DE82-902329, NP-2902329) Avail NTIS (US Sales Only) HC A05/MF A01, DOE Depository Libraries

The planning procedures for the energy program and policy guidelines for energy planning are presented. Future changes in marginal costs and directions indicated for economically efficient pricing are assessed. The aim of the conservation program is to close the gap between the amounts of conservation which is rationally cost effective and that projected to occur anyway through normal market forces. An overview of energy demand and proposed plans for energy supply are given. Liquid fuels have priority although

work on coal receives new emphasis. A better program on energy demand and management is suggested. DOE

N83-16903# Purdue Univ, Lafayette, Ind
ENERGY CONSERVATION IN HISTORIC STRUCTURES: AN INFORMATION/AWARENESS BULLETIN

F. T. SPARROW, ed. and S. J. KOPKA, ed. 1981 544 p refs (Contract DE-AC02-80CS-30401)

(DE82-005212; DOE/CS-30401/1) Avail NTIS HC A23/MF A01

Energy conserving features of selected historic structures are investigated. Site specific data, concerned with 18th to 20th century historic structures and their predominantly passive energy conservation features are emphasized. The US was divided into 4 climatic bioregions - hot-humid, temperate, hot-arid, and cool northern regions. Research information was compiled for each of the four climatic regions. The climatic region i.e., its inherent climatic/physiographic characters and the social/cultural history are discussed. The four emphasis areas (ventilation, cooling, etc.) as they relate to the specific climatic region are also discussed. Features were considered according to their prevalence and specific reference is made to sites in which the features were displayed. Two in-depth case studies are presented in which the energy conserving features of a specific site are explored. DOE

N83-16921# California Energy Commission, Sacramento
COGENERATION IN MUNICIPALITIES. PROCEEDINGS FROM WORKSHOPS FOR LOCAL GOVERNMENTS AND MUNICIPAL UTILITIES

S. PATTERSON, ed. Jan 1982 71 p refs Workshops held 18 Nov, 1981, Sacramento, Calif. and 4 Dec. 1981, Los Angeles (DE82-905758, P-500-82-005) Avail NTIS HC A08/MF A01

The energy situation, cogeneration systems, cogeneration potential, advantages of cogeneration, the California Energy Commission projects, issues in development, and the reasons cities should be interested are reviewed. DOE

N83-16923# Royal Inst of Tech., Lund (Sweden)
ELECTRIC LOAD OF RESISTANCE HEATED ONE-FAMILY HOUSES: AN EMPIRIC ANALYSIS

L. LARSSON May 1981 31 p refs In SWEDISH (DE82-901536, LUTMDC/TMVK-3095/1-24(1981)) Avail NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

An analysis is presented of the electric load statistics of 33 one-family houses in a suburban area in Gothenburg, Sweden. The loads from electric space heating, were measured. The mean load was recorded every 15 minutes. Comparison is made to two theoretical models. DOE

N83-16924# Science Applications, Inc., Oak Ridge, Tenn
EVALUATION OF UTILITY HOME-ENERGY-AUDIT PROGRAMS: A WISCONSIN EXAMPLE

S. GRADY and E. HIRST Oak Ridge, Tenn. ORNL Mar 1982 41 p refs

(Contract W-7405-ENG-26)

(DE82-008134, ORNL/CON-88) Avail NTIS HC A03/MF A01

In February 1978, the Wisconsin Power & Light Company (WPL) offered its residential gas-space-heating customers free onsite energy audits. Between then and June 1980, WPL audited about 19 thousand homes, one-fourth of their gas customers. The audit program included an evaluation of natural gas consumption records, the need for specific weatherization measures (as determined during their energy audits), and customers reports of their demographic characteristics and recent energy conservation practices and measures. The two groups differed significantly only with respect to conservation measures; this difference was probably due, in part, to the 1978 audits. Regression equations were developed to explain natural gas use for the two heating seasons after the 1978 audit. The results showed the importance of floor area, age of house, household income, number of occupants, and temperature setting on gas use. DOE

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-16925# Los Alamos Scientific Lab., N. Mex.

ENERGY OPTIMIZATION IN DOD FACILITIES

F. ROACH, C. KIRSCHNER (New Mexico Univ., Albuquerque), and R. SALMON (New Mexico Univ., Albuquerque) 1981 10 p refs Presented at the 4th Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 14-16 Dec 1981 Submitted for publication

(Contract W-7405-ENG-36)

(DE82-008108, LA-UR-82-522) Avail NTIS HC A02/MF A01

A static linear programming formulation (management tool) of energy optimization problems on military bases was developed to assist each of the military services in their planning activities and budgetary allocation decisions. Several objective functions were defined, resulting in two types of model capabilities, minimization of capital costs (investments) subject to a number of energy and dollar constraints and the maximization of energy savings subject to capital and operating fund budget restrictions and minimum energy performance goals. The management tool defines various levels of aggregation in terms of (1) geographical boundaries, (2) end use energy demand, (3) building type characteristics, (4) conservation options, (5) renewable energy and alternative fuel technologies, and (6) a limited set of advanced energy technology options DOE

N83-16926# Brookhaven National Lab., Upton, N. Y.

MODELING ENERGY/ECONOMY INTERACTIONS FOR CONSERVATION AND RENEWABLE ENERGY-POLICY ANALYSIS

P. J. GRONCKI 1981 31 p refs Presented at the 3rd Ann. Meeting of the Intern. Assoc. of Energy Econ., Houston, Tex., 12-13 Nov 1981

(Contract DE-AC02-76CH-00016)

(DE82-009159, BNL-30931; CONF-811189-1) Avail NTIS HC A03/MF A01

Energy policy and the implications for policy analysis and the methodological tools are discussed. The evolution of one methodological approach and the combined modeling system of the component models, their evolution in response to changing analytic needs, and the development of the integrated framework are reported. The analyses performed over the past several years are summarized. The current philosophy behind energy policy is discussed and compared to recent history. Implications for current policy analysis and methodological approaches are drawn. GRA

N83-16929# Gesellschaft fuer Elektrometallurgie m b H., Duesseldorf (West Germany)

REPLACEMENT OF LUMPY CHROME ORE BY AGGLOMERATED ORE CONCENTRATES AND LOWERING OF SPECIFIC POWER CONSUMPTION AND IMPROVEMENT OF CR YIELD BY MEANS OF IMPROVED SLAG COMPOSITION IN THE PRODUCTION OF HC FERROCHROME Final Report, Mar. 1981

H. J. RETELSDORF, R. FICHTE, F. BREUER, and H. ZIMMERMANN Bonn Bundesministerium fuer Forschung und Technologie Jun 1982 16 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-82-084, ISSN-0340-7608) Avail NTIS HC A02/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 3,50

Improved slag compositions for the FeCr 4 to 6 % C process were developed in order to increase the Cr yield and lower the specific power consumption. Furthermore, replacement of lumpy ore in the charge by agglomerated Cr-ore-fines or concentrates in the form of pellets and briquettes was tested. Experiments were performed in a 70 kW and a 300 kW arc furnace. Two different slag compositions were tested. The high-MgO slag type proved suitable. The specific power consumption and the Cr yield depends to a large extent on the type of Cr ore and on the agglomeration process. Cr ore pellets can be used up to 65% in the ore charge, but briquettes only up to 25% to replace lumpy ores without causing higher Cr losses in the slag. Author (ESA)

N83-16930# AEG-Telefunken, Nuremberg (West Germany)

HEATING OF DOMESTIC WATER BY WASTE HEAT RECOVERY FROM HOUSEHOLD REFRIGERATING EQUIPMENT Final Report, Sep. 1981

J. REIL, B. KASTER, and M. WEGNER (Forschungsstelle fuer Energiewirtschaft) Bonn Bundesministerium fuer Forschung und Technologie Sep 1982 218 p In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-82-156, ISSN-0340-7608) Avail NTIS HC A10/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 38,50

Heat from a 370 l deep freeze was used to heat water in a 250 l boiler. Both units were made from mass produced components. Tests show that the functions of cooling and deep freezing units can be effectively combined with one warm water boiler. The necessary expenditure for the appliance is, however, only economical with deep freezing units because with normal domestic refrigerators the amount of waste heat is too small. The economy of the unit could be considerably increased by the development of a mass produced motor compressor with a sufficiently large oil cooler to accomplish an optimum thermal insulation of the motor compressor surface area. Author (ESA)

N83-16942# Pope, Evans, and Robbins, Inc., New York.

CONGENERATION FEASIBILITY: OTIS ELEVATOR COMPANY AND POLYCHROME CORPORATION Final Report

H. FOX May 1982 118 p Sponsored in part by Otis Elevator Co. and Westchester County, NY

(PB82-263526, NYSERDA-82-17) Avail NTIS HC A06/MF A01 CSCL 10B

An investigation of the technical and economic feasibility of cogenerating electric and thermal power at two manufacturing plants (Otis Elevator Company and Polychrome Corporation) located on neighboring properties in Yonkers, NY is discussed. Existing electrical and steam producing equipment and energy consumption data are summarized. Alternative cases examined include electrical energy generation, electrical energy generation with waste heat recovery and a combined cycle case. Also reported are life cycle cost economic evaluations including simple payback period and return on investment indices. While it was concluded that cogeneration of heat and electricity at these industrial plant sites would not be economically viable, this detailed study provides valuable insights. GRA

N83-16943# Brooklyn Union Gas Co., N. Y.

LANDFILL GAS TO ELECTRICITY DEMONSTRATION PROJECT Final Report

A. J. GIULIANI and L. A. CAGLIOSTRO Mar 1982 102 p refs Sponsored in part by DOE

(PB82-255290, NYSERDA-82-2, REPT-109/ET-FUC/79) Avail NTIS HC A06/MF A01 CSCL 21D

Medium Btu methane gas is a naturally occurring by product of anaerobic digestion of landfilled municipal solid waste. The energy potential of landfill gas in New York State is estimated to be 61 trillion Btu's per year or the equivalent of 10 percent of the natural gas used annually in the State. The 18-month Landfill Gas to Electricity Demonstration Project conducted at the Fresh Kills Landfill in Staten Island, New York conclusively demonstrated that landfill gas is an acceptable fuel for producing electricity using an internal combustion engine/generator set. Landfill gas proved to be a reliable and consistent fuel source during a six-month field test program. Engine exhaust emissions were determined to be comparable to that of natural gas and no unusually high corrosion rates on standard pipeline material were found. GRA

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-16945# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Stuttgart (West Germany). Inst. fuer Bauphysik.

HEAT ENERGY CONSUMPTION AND INTERMITTENT HEATING

N. KOENIG and C. KUPKE Aug. 1982 49 p refs Transl. into ENGLISH of a German mono., Aug. 1980 Original language document announced as N81-24580 Sponsored in part by Bundesministerium fuer Forschung und Technologie, Bonn (PB82-255159; BMFT-FB-T-80-072) Avail: NTIS HC A03/MF A01 CSCL 13A

A quantitative assessment of the possible reduction in space heating energy consumption when using an intermittent heating mode as compared to a continuous heating mode is offered. In situ measurement methods used in rooms with different heat storage capacity and different heating systems or heating appliances are described. A variation on energy consumption is presented. A comparison of experiment with calculations indicates that in an ordinary residence an energy savings of 10 to 35 percent can be achieved by employing an intermittent heating mode, depending on the type of wall construction and the number of hours various rooms are in use. Moreover, for the heating of offices and factories, the use of electronic control systems can lead to savings of 50 percent in heat energy consumption. GRA

N83-16947# Thermo Electron Corp., Waltham, Mass. **OPEN-CYCLE VAPOR COMPRESSION HEAT PUMP Annual Progress Report**

F. E. BECKER and A. E. RUGGLES 1981 81 p

(Contract GRI-5011-342-009)

(PB82-262569; TE4224-239-82; GRI-81/0059) Avail: NTIS HC A05/MF A01 CSCL 13A

A prototype gas-fired steam heat pump was developed. The system utilizes a dry screw compressor driven by a 500-hp natural gas industrial engine. The system can recompress 10,000 lb per hr of clean steam over a 3 to 1 pressure ratio. The fuel consumption of this system is approximately 50 percent that of a direct-fired boiler. A similar size system capable of operating with contaminated steam is also being developed. GRA

N83-16953# Louisiana State Univ., Baton Rouge Coastal Studies Inst

THE EFFECTS OF WEATHER SYSTEMS, CURRENTS AND COASTAL PROCESSES ON MAJOR OIL SPILLS AT SEA

S. P. MURRAY 1982 63 p refs

(Contract N00014-75-C-0192)

(AD-A120221; TR-343) Avail: NTIS HC A04/MF A01 CSCL 08C

Review of the effect of weather phenomena on continental shelves and coastal waters has clearly demonstrated their dominant role in forcing the motion of these waters. As the response of oil to wind forcing will be largely controlled by the type of weather characteristic of different climatic regions throughout the world, the paper will begin with a brief summary of the time and length scales of weather systems. Next, the oil dispersal problem will be discussed in terms of the physical and chemical properties of oil on the sea surface and then the geophysical processes (currents, tides, etc.) that experience has shown us to be important will be considered. Hydrodynamic details will not be emphasized, but rather case studies from major oil spills will next be called on to demonstrate the role of basic physical processes in determining oil motion. A brief review of the major types of models currently employed to aid in understanding or predicting oil spill movement will then be presented; it will be followed by a summary and evaluation of what I see to be the role physical oceanography will play in future oil spill incidents. GRA

N83-16954# State Univ. of New York, Stony Brook. Manne Sciences Research Center

COAL-WASTE ARTIFICIAL-REEF PROGRAM, PHASE 3. VOLUME 2: COMPREHENSIVE REPORT

J. H. PARKER, P. M. J. WOODHEAD, and I. W. DUEDELL Nov 1981 451 p refs Sponsored by EPRI, New York State Energy Research and Development Authority, EPA, DOE and Power Authority of the State of New York

(Contract EPRI PROJ. 1341-1)

(DE82-005591; EPRI-CS-2009-VOL-2; CS-2009-VOL-2) Avail:

NTIS HC A20/MF A01

The objective of the coal-waste artificial reef program is to explore the technical feasibility and the environmental effects of a method for ocean disposal of fly ash and scrubber sludge, combustion wastes from power plants. The program constructed a demonstration artificial reef in the Atlantic Ocean off Long Island from about 15,000 stabilized blocks of these coal waste materials. Techniques were developed for coal waste block fabrication utilizing machines and equipment from the concrete block industry. Accelerated steam curing procedures developed block strengths adequate for industrial handling and stacking. A series of laboratory studies determined the physical and chemical properties and leachate characteristics of a variety of coal waste blocks and their interactions in seawater systems. In laboratory bioassays and in field tests, the material did not appear to be toxic in the sea. These results all suggested that the blocks are compatible with the marine environment. DOE

N83-16955# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.

IDENTIFICATION AND REMOVAL OF THE ORGANIC COMPOUNDS IN COAL-CONVERSION CONDENSATE WATERS

D. H. MOHR, JR. and C. J. KING Nov. 1981 10 p refs

Presented at the Wastewater Workshop, Germantown, Md., 24-25 Jun. 1981 Submitted for publication

(Contract W-7405-ENG-48)

(DE82-004825; LBL-13584, CONF-8106109-3) Avail: NTIS HC A02/MF A01

Solvent extraction studies show that a large fraction of the chemical oxygen demand (COD) can be economically removed with solvent extraction and steam stripping. The fraction of the COD which remains is significant and is composed of very polar compounds. A high-performance liquid chromatography technique was developed which provides qualitative and quantitative information about these compounds, as well as phenolics. This technique uses an evaporative solvent change from water to isopropanol, which allows identification by gas chromatography and mass spectroscopy. Dimethyl hydantoin and related compounds were identified in a coal gasification condensate water for the first time. However, the levels of these compounds appear to be affected by sample age and storage conditions. DOE

N83-16956# California Univ., Livermore. Lawrence Livermore Lab.

CHEMICAL CHARACTERIZATION OF ORGANIC CONTAMINANTS IN GROUNDWATER NEAR AN UNDERGROUND COAL GASIFICATION SITE

D. H. STUERMER, D. J. NG, and C. J. MORRIS Nov. 1981 23 p refs

Presented at the DOE Workshop on Chem. Characterization of Hazardous Substances in Synfuels, Seattle, 4-6 Nov. 1981

(Contract W-7405-ENG-48)

(DE82-004822; UCRL-86983; CONF-811160-1) Avail: NTIS HC A02/MF A01

Groundwater samples collected near three underground coal gasification (UCG) sites in the Powder River Basin near Gillette, Wyoming were analyzed for dissolved organic contaminants. The contaminants consisted of a rather simple mixture of phenols, aromatic hydrocarbons, pyridines, quinolines, and isoquinolines. The same groupings of contaminants were observed in samples from different sites and different aquifers although the relative concentrations of compounds varied widely. Apparently, partitioning

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

of the deposited by-product tars between the water and the aquifer substrate results in this similarity of composition. Naphthalene, oxylene, 2-methylpyridine, and o-cresol were consistently present at relatively high concentrations in contaminated samples and could, therefore, be used as indicators of UCG contaminants. A simplified method of analysis was developed to monitor for these indicator compounds in groundwater that employed liquid-liquid extraction at pH 8.2 followed by gas chromatography and, when required, gas chromatography-mass spectrometry analysis. DOE

N83-16959# Oak Ridge National Lab., Tenn. HEALTH AND SAFETY ISSUES OF ALTERNATE ENERGY SYSTEMS

A. P. WATSON, E. L. ETNIER, and P. J. WALSH 1981 19 p refs Presented at the ANS Executive Conf. on Alternate Energy Sources for Elec Power, Cape Code, Mass., 4 Oct. 1981 (Contract W-7405-ENG-26)

(DE82-002918; CONF-8110117-1) Avail NTIS HC A02/MF A01

An evaluation of potential occupational and public health aspects of geothermal, biomass, solar, and fossil energy technologies was performed. Identification of potentially hazardous processes of each fuel cycle was made, as well as development of quantitative evaluation when necessary data were available. Occupational exposure to hydrogen sulfide gas occurs near all geothermal sites. Principal health and safety considerations of biomass pathways are directly related to the diffuse nature of solar energy fixation by photosynthesis and subsequent transfer to animal food chains. Unique hazards associated with solar energy include occupational exposures to Cd and As during manufacture of photovoltaic cells. Potential occupational hazards during production of synfuels from coal and oil shale include accidents and disease resulting from ore removal, and dermal and inhalation exposures to carcinogens, tumorigens, and caustic agents. DOE

N83-16961# California Univ., Berkeley Lawrence Berkeley Lab Biology and Medicine Div IS NUCLEAR ENERGY AN UNACCEPTABLE HAZARD TO HEALTH?

J. I. FABRIKANT Nov. 1981 10 p Presented at the 109th Ann Meeting of the Am Public Health Assoc., Los Angeles, 1-5 Nov 1981

(Contract W-7405-ENG-48)

(DE82-004954, LBL-13586; CONF-811159-1) Avail NTIS HC A02/MF A01

Five conclusions were drawn. (1) health evaluation of energy-generating sources for electricity must be limited, at the present time, to coal, oil, natural gas, and nuclear. Coal and nuclear power will be the principal fuels for electric power production in the next 25 years. Systematic utilization of alternative renewable energy sources for power production will not have yet been accomplished; (2) comparison can be made of estimates of morbidity and mortality, and evaluation of long-term delayed health effects such as carcinogenesis and genetic effects; (3) at the present time, fossil fuels, primarily coal, have greater adverse impact on health than does nuclear power production; (4) nuclear power reactors emit low-level radiation under normal operating conditions. Federal regulations limit the radiation dose to levels which are only a small fraction of the annual average natural background radiation in the United States. Such low levels of radiation do not result in adverse health effects; and (5) efforts must be directed toward reducing any adverse health impacts of all forms of energy production. DOE

N83-16964# California Univ., Berkeley Lawrence Berkeley Lab.

RADON-DAUGHTER EXPOSURES IN ENERGY-EFFICIENT BUILDINGS

A. V. NERO, J. V. BERK, M. L. BOEGEL, C. D. HOLLOWELL, J. G. INGERSOLL, and W. W. NAZAROFF Oct 1981 10 p refs Presented at the Spec. Meeting on Assessment of Radon and Daughter Exposure and Related Biol. Effects, Rome, 3-7 Mar 1980

(Contract W-7405-ENG-48)

(DE82-003711; LBL-11052, CONF-800398-4) Avail NTIS HC A02/MF A01

Measures that reduce energy use by reducing natural infiltration or mechanical ventilation in new or retrofit buildings are discussed. Measurements in buildings specifically designed to use energy efficiently or utilize solar heating were performed. In many of these buildings radon concentrations appear to arise primarily from soil underlying the buildings. Measures to control higher levels, e.g., by mechanical ventilation with heat recuperation, appear to be economical. However, to evaluate energy-saving programs adequately requires a much more comprehensive characterization of radon sources (for example, by geographical area) and a much fuller understanding of the dynamics of radon and its daughters indoors than now exist. Author

N83-16971# Los Alamos Scientific Lab., N. Mex PENETRATION AND AIR-EMISSION-REDUCTION BENEFITS OF SOLAR TECHNOLOGIES IN THE ELECTRIC UTILITIES

R. J. SUTHERLAND 1981 12 p refs Presented at the 4th Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 14 Dec. 1981

(Contract W-7405-ENG-36)

(DE82-002637, LA-UR-81-3252, CONF-811212-1) Avail NTIS HC A02/MF A01

The results of a study of four solar energy technologies and the electric utility industry are reported. The purpose was to estimate the penetration by federal region of four solar technologies: wind, biomass, photovoltaics, and solar thermal, in terms of installed capacity and power generated. The penetration by these technologies occurs at the expense of coal and nuclear power. The displacement of coal plants implies a displacement of their air emissions. The main conclusion is that solar thermal, photovoltaics, and biomass fail to penetrate significantly by the end of this century in any federal region. Wind energy penetrates the electric utility industry in several regions during the 1990s. A moderate displacement of sulfur dioxide and the oxides of nitrogen is estimated to occur by the end of this century, and significant lowering of these emissions should occur in the early part of the next century. DOE

N83-16972# Oak Ridge National Lab., Tenn. Energy Div. THE IMPLICATIONS OF A STOCHASTIC APPROACH TO AIR-QUALITY REGULATIONS

A. J. WITTEN, F. C. KORNEGAY, D. B. HUNSAKER, JR., E. C. LONG, JR., R. D. SHARP, P. J. WALSH, E. A. ZEIGHAMI, J. S. GORDON (Engineering Societies Commission on Energy), and W. L. LIN (ERAS, Inc.) Sep 1982 114 p refs

(Contract W-7405-ENG-26)

(DE83-001636, ORNL/TM-8440) Avail NTIS HC A06/MF A01

The viability of a stochastic approach to air quality regulation is discussed. The stochastic approach considered is one which incorporates the variability which exists in sulfur dioxide (SO₂) emissions from coal-fired power plants. Emission variability arises from a combination of many factors including variability in the composition of as-received coal such as sulfur content, moisture content, ash content, and heating value, as well as variability which is introduced in power plant operations. The stochastic approach as conceived addresses variability by taking the SO₂ emission rate to be a random variable with specified statistics. Given the statistical description of the emission rate and known meteorological conditions, it is possible to predict the probability of a facility exceeding a specified emission limit or violating an established air quality standard. The implications of accounting

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

for emissions variability by allowing compliance to be interpreted as an allowable probability of occurrence of given events is also discussed. Health benefits and economic factors are discussed

DOE

N83-16973# Pacific Northwest Lab., Richland, Wash GUIDELINES FOR SAMPLING AND ANALYZING SOLUTIONS FOR AQUIFER THERMAL-ENERGY-STORAGE SYSTEMS

W. J. DEUTSCH Sep 1982 15 p refs

(Contract DE-AC06-76RL-01830)

(DE83-001852; PNL-4355) Avail: NTIS HC A02/MF A01

The successful aquifer storage and retrieval of energy in the form of heated or chilled water require that the engineered system be compatible with the natural ground water system. The composition of the ground water must be well known to predict and avoid potential problems that heating or cooling the water may create for operation of the plant. A set of guidelines for sampling and analyzing solutions from simulated or real groundwater energy storage systems is given. Sampling guidelines include methods for flushing wells of stagnant water and monitoring selective solution parameters (pH, Eh, temperature or conductivity) as indicators of the efficiency of flushing. Certain unstable groundwater parameters (temperature, pH, Eh, dissolved oxygen, and conductivity) should be measured onsite. It is recommended that alkalinity, sulfide, and ammonia determinations be done within 24 hr of sampling. Samples of the ground water should be filtered, preserved, and stored for laboratory analysis of major cations, anions, trace metals, organic and inorganic carbon and certain redox couples (Fe(2) Fe(3)) and (As(3) As(5))

DOE

N83-16976# Argonne National Lab., Ill. Chemical Engineering Div.

ALKALI-METAL-VAPOR REMOVAL FROM PRESSURIZED FLUIDIZED-BED COMBUSTOR FLUE GAS Annual Report, Oct. 1980 - Sep. 1981

I. JOHNSON and S. H. D LEE Jan. 1982 38 p refs

(Contract W-31-109-ENG-38)

(DE82-008088; ANL/FE-81-59) Avail: NTIS HC A03/MF A01

Methods for the cleanup of high-temperature, high-pressure combustion gases from pressurized fluidized-bed coal combustors so that the cleaned gases can be used to power downstream gas turbines are discussed. Data are presented on the use of activated bauxite in a granular bed filter for the removal of gaseous NaCl from hot (800 C), pressurized (approximately less than 8 atm), wet simulated flue gas. Also, the sorption mechanisms are discussed. Greater than 99.9% NaCl vapor capture was achieved. Also reported are the effects of several operating variables on the rate of leaching of NaCl that was adsorbed on activated bauxite and the volatility of alkali metal compounds present as impurities in activated bauxite. Finally, the preliminary estimate of the cost of using activated bauxite for the control of alkali vapors from flue gas was updated; a conceptual design of a fixed granular-bed filter was presented; and the energy needs and their costs for operating the filter in the once-through and the sorbent-regeneration modes were compared

DOE

N83-16977# Oak Ridge National Lab., Tenn. Environmental Sciences Div.

ENVIRONMENTRICS OF SYNFUELS. PART 4: PROJECT RESULTS TRACKING SYSTEM (PRTS)

R. H. STRAND, M. P. FARRELL, K. L. DANIELS, and J. C. GOYERT 1982 93 p refs Presented at the SAS Users Group Intern Meeting, San Francisco, 14 Feb. 1982

(Contract W-7405-ENG-26)

(DE82-011444, CONF-820219-2) Avail: NTIS HC A05/MF A01

An assessment of the environmental and health effects of a low-Btu coal gasification facility are discussed. The sampling program generated over 2.5 million records characterizing, documenting, and estimating various environmental and process-related parameters. A Project Results Tracking System (PRTS) was designed and implemented to account for and summarize the status of all samples taken during the project. The results of the computerization effort are given. The PRTS operates

on a request record providing information on the samples and what analyses are needed and processes a result record containing analytical results corresponding to those requested for the sample. The results as they are reported are merged with the request records to complete the requested transactions. A library of routines for generating exception reports and status reports was created. A formatted code library with over 500 codes was implemented

DOE

N83-16979# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Physik

SIMULATION OF AIR-POLLUTION PROPAGATION RESULTING FROM AT-SEA INCINERATION WASTES

D. EPEL, J. HAEUSER, H. T. MENGELKAMP, and A. MUELLER 1981 11 p refs Presented at the 5th Intern. Clean Air Congr., Buenos Aires, 20-26 Oct 1980

(DE82-902297, GKSS-80/E/57) Avail: NTIS (US Sales Only)

HC A02/MF A01, DOE Depository Libraries

The model MODIS is used for simulating the transport of the hydrogen chloride plume stemming from the at sea incineration of chemical wastes. The construction of the wind field by a simple meteorological model is described, and wash out and absorption parameters used are given.

DOE

N83-16985# National Oceanic and Atmospheric Administration, Boulder, Colo. Office of Marine Pollution Assessment

EFFECTS OF PETROLEUM ON SELECTED UNIFORM SUBSTRATES: A FEASIBILITY STUDY

A. SCHOENER and F. B. DEWALLE Jun 1982 55 p refs

(PB82-255084, NOAA-TM-OMPA-18, NOAA-82072101) Avail:

NTIS HC A04/MF A01 CSCL 08A

By oiling an early colonizing species of replicate substrates the effects of a one-time oiling event on an initial hard substrate colonizer, the encrusting bryozoan *Parasmittina trispinosa*, was simulated. Subsequent community development was then monitored over a period of several months. Experimental manipulations were conducted in the laboratory on panels which prior to and manipulation events were positioned in the natural environment. Panels whose bryozoan colonies were removed but received no subsequent oiling of the vacant spot had a higher percent of cover 10 days after manipulations than those panels receiving oil after the bryozoan removals. These panels also eventually achieved the highest total percent coverage

GRA

N83-17067# Oak Ridge National Lab., Tenn. DEVELOPMENT OF STATISTICAL DATABASES FOR TOXICOLOGICAL STUDIES

K. L. DANIELS and J. GOYERT 1981 23 p refs Presented at the Workshop on Statist. Databases for Toxicol. Studies, Menlo Park, Calif., 2 Dec 1981

(Contract W-7405-ENG-26)

(DE82-005196, CONF-811208-3) Avail: NTIS HC A02/MF A01

Methods for assessing the effects of coal derived synthetic fuels on the aquatic environment are discussed. An approach is presented that was used to develop and implement a statistical data base for analyzing these effects. Fifty-four separate acute bioassay tests were conducted by six investigators using nine species, six compounds, and multiple exposure concentrations/compound with three to five replicates per exposure concentration/compound. Organisms from each species were exposed to several concentrations of each compound and a response was noted. The Statistical Analysis System (SAS) software package running under IBM's Virtual System in a time share option environment was used from data base management, statistical analysis, and graphical display. Partitioned raw data files, SAS program files, and SAS data bases were used to maintain the integrity of each investigator's data and to allow for ready access to all data.

DOE

N83-17086# Institut de Recherche des Transports, Arcueil (France). Centre d'Evaluation et de Recherche des Nuisances et de l'Energie
INFLUENCE OF DRIVER BEHAVIOR ON FUEL CONSUMPTION: BIBLIOGRAPHIC STUDY

G LABIALE May 1982 80 p refs In FRENCH, ENGLISH summary (IRT-58, ISBN-2-85782-094-1, ISSN-0150-8997) Avail NTIS HC A05/MF A01

The literature on the effect of different types of driving upon the parameters of mechanical vehicle use and upon fuel consumption, and on the efficiency of indicators and aids to vehicle driving as regards fuel consumption, was studied. The differences in fuel consumption between drivers are between 8 % and 10 %, but can reach 50 % between the extreme consumption levels. The difference of the fuel consumption of the same driver related to different motivations is between 8 % and 23 % but can reach 25 % between the extreme consumption levels. These variabilities of fuel consumption are related to vehicle use parameters such as acceleration, variability of acceleration, normal running of engine, and speed. Research which stresses the analysis of driver behavior and driving strategies, as well as the interaction of the road-vehicle-driver system in order to state fuel consumption and determine economical driving models, is proposed. Author (ESA)

N83-17365*# Jackson State Univ., Miss Dept of General Science.

A PRELIMINARY STUDY OF ENVIRONMENTAL PARAMETERS ASSOCIATED WITH THE FEASIBILITY OF A POLYGENERATION PLANT AT KENNEDY SPACE CENTER

G D BARNES In NASA Marshall Space Flight Center The 1982 NASA/ASEE Summer Fac. Fellowship Program 18 p Aug. 1982 refs

Avail: NTIS HC A99/MF A01 CSCL 13B

The feasibility of a polygeneration plant at Kennedy Space Center was studied. Liquid hydrogen and gaseous nitrogen are the two principal products in consideration. Environmental parameters (air quality, water quality, biological diversity and hazardous waste disposal) necessary for the feasibility study were investigated. A National Environmental Policy Act (NEPA) project flow sheet was to be formulated for the environmental impact statement. Water quality criteria for Florida waters were to be established. Author

N83-17428# Trans Systems Corp., Vienna, Va
ASSESSMENT OF BATTERY BUSES AND BATTERY TECHNOLOGY Final Report, Aug. 1981 - May 1982

J C H WOO, E J LONGSTREET, and W RAITHEL Washington Urban Mass Transportation Administration May 1982 93 p refs

(Contract DOT-UMTA-VA-06-0087)

(PB82-260019, TS-123; UMTA-VA-06-0087-82-1) Avail NTIS HC A05/MF A01 CSCL 13F

Public concern with the deterioration of the quality of the environment caused by air, water, and noise pollution, became a major public issue during the 1960s resulting in the passage of new legislation and institutional changes in the United States. This concern was not limited to the United States, but also made itself felt with similar intensity in most of the other industrialized nations. One consequence was a renewed interest in the use of electric power for propulsion with reduced pollutant emissions and noise levels as a substitute for the internal combustion engine. Because of its effect on the urban environment and its visibility, the transit bus became a prime target for conversion to electric propulsion, particularly through the use of the electric storage battery. In general, electric power is now an attractive alternative to the use of petroleum-based fuels in urban transportation. GRA

N83-17455# Department of Energy, Washington, D C.
SYMPOSIUM ON COMMERCIAL AVIATION ENERGY CONSERVATION STRATEGIES. PAPERS AND PRESENTATIONS

Apr 1981 385 p refs Symp. held in Washington, D.C., 2-3 Apr 1981 Sponsored in cooperation with FAA (AD-A107106) Avail. NTIS HC A17/MF A01 CSCL 01B

Current and future efforts to conserve fuel and to promote energy conservation within the commercial aviation sector were discussed. Energy conservation programs such as flight operations, air traffic control, engineering and maintenance, and corporate management strategies are included.

N83-17456# Aerospace Corp., El Segundo, Calif
POTENTIAL FUEL SAVINGS THROUGH IMPROVED AIRFRAME MAINTENANCE

R R. COVEY, B M PERSHING, and R S. KNIGHT (Continental Airlines) In DOE Symp. on Com. Aviation Energy Conserv Strategies p 3-30 Apr 1981 refs Avail NTIS HC A17/MF A01 CSCL 01B

Potential fuel savings obtainable through improved airframe maintenance of commercial jet transport aircraft was studied. In the two-task program, one task developed and utilized methods to project analytically the potential improved airframe maintenance-related savings of each aircraft in a fleet of 15 DC-10's. These projections were formulated using a discrepancy data base developed from detailed physical inspections of each aircraft. The second task addressed the verification of fuel savings through the collection and analysis of pre- and post-maintenance flight performance data obtained on two of the DC-10's while in normal revenue service. Based on multivariable linear regression analyses of the flight data, one aircraft showed a decrease in fuel consumption of 0.4 percent at a confidence level in excess of 98 percent, compared to an analytical projection of 0.6 percent. Flight verification results from the second aircraft were inconclusive due to collection of a significant block of data under unstable flight conditions. Author

N83-17458# Peat, Marwick, Mitchell and Co., San Francisco, Calif

AIRCRAFT TOWING FEASIBILITY STUDY

H S L FAN and D. G HANEY In DOE Symp on Com Aviation Energy Conserv. Strategies p 45-56 Apr. 1981 refs Avail. NTIS HC A17/MF A01 CSCL 01B

The feasibility and constraints of towing aircraft between runways and terminal gate areas as a fuel conservation measure were studied. Author

N83-17459# Systems Control, Inc., West Palm Beach, Fla. Technology Industries Div

THE ANALYSIS OF INTEGRATED FUEL EFFICIENT, LOW NOISE PROCEDURES IN LAX TERMINAL AREA OPERATIONS

J. B MCKINLEY and R L. BOWLES (FAA) In DOE Symp. on Com Aviation Energy Conserv Strategies p 57-78 Apr 1981 refs Originally announced as N82-13014

Avail: NTIS HC A17/MF A01 CSCL 01B

Terminal area fuel conservation and airport noise level relationships are investigated. The potential fuel savings and noise level reduction in the Los Angeles International (LAX) terminal area were quantified. Relaxation of current noise abatement procedure without impacting 1980 noise levels, and at the same time conserving additional fuel was determined. Author

N83-17460# Federal Aviation Administration, Washington, D.C. Energy Div

AN OVERVIEW OF THE DOT/FAA AVIATION ENERGY CONSERVATION POLICY

C J HOCH In DOE Symp. on Com Aviation Energy Conserv. Strategies p 79-94 Apr. 1981 Avail NTIS HC A17/MF A01 CSCL 01B

An overview of the FAA aviation energy conservation policy is presented. NW

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-17463# Northwest Airlines, Inc., Minneapolis, Minn
FUEL CONSERVATION TECHNIQUES IN JET TRANSPORT AIRCRAFT OPERATIONS

H H CRAVEN, JR /in DOE Symp on Com. Aviation Energy Conserv Strategies p 137-146 Apr 1981
Avail NTIS HC A17/MF A01 CSCL 01B

Fuel economy and aerodynamic efficiency in jet transport aircraft operations are discussed. The operational procedures recommended by the aircraft manufacturers were examined, and reasonable alternatives when ATC or flight conditions make those procedures either impractical or impossible are suggested. Basic aerodynamic considerations and their effects on engine and aerodynamic efficiency are emphasized. A density altitude chart with weight limitations for the B-747-1/7A Thrust aircraft, a fuel planning graph for the same airplane, comparative power charts and computer run offs to help substantiate the information are included. E A K.

N83-17464# Eastern Air Lines, Inc., Atlanta, Ga Air Traffic Systems Dept

AIR TRAFFIC CONTROL: ITS EFFECT ON FUEL CONSERVATION

E H PRICE /in DOE Symp on Com Aviation Energy Conserv. Strategies p 147-162 Apr 1981
Avail: NTIS HC A17/MF A01 CSCL 01B

Air traffic delays and its cost in waste fuel were examined. It is suggested that the most productive way to reduce this huge waste of fuel is to develop a more efficient ATC system, one that minimizes delays and still provides for reasonable growth in air traffic. Ways to resolve air traffic increase are suggested to increase capacity and reduce delays. A number of programs to help the users save fuel are implemented: (1) local flow traffic management, (2) pilot discretion descents, (3) more frequent approval of direct routes, (4) more frequent approval of requested altitudes, and (5) unrestricted climb to altitude. These procedures allow aircraft to remain higher, longer, at the more fuel efficient altitudes. E A K.

N83-17465# United Air Lines, Inc., Denver, Colo Maintenance Operations Div

COMPUTERIZED ENGINE AND AIRPLANE PERFORMANCE MONITORING PROGRAMS

M B SCHWARTZ and A E DOMKE /in DOE Symp. on Com Aviation Energy Conserv. Strategies p 171-208 Apr 1981
Avail: NTIS HC A17/MF A01 CSCL 01B

Computerized engine and airplane monitoring programs, an important element among the many fuel conservation activities were examined. These systems provide ongoing information on the condition of each individual airplane and the health of the installed engines. Any airplane or engine performance deterioration is apparent and further investigation can be implemented and the necessary action taken. Efforts to audit the effects of performance altering factors are discussed. The Cruise Data Survey System used to measure drag differences between reverser configurations on the 727 airplanes is presented. Long term performance deterioration and the economic unfeasibility of restoring engines and airplanes to new condition are discussed. E A K.

N83-17466# Lufthansa German Airlines, Cologne (West Germany)

SLIDESLIP INDICATION SYSTEM

D HORST /in DOE Symp on Com Aviation Energy Conserv Strategies p 209-230 Apr 1981 Previously announced as N82-25181

Avail: NTIS HC A17/MF A01 CSCL 01B

The development of a sideslip indication system for aircraft fuel conservation is outlined. A stall warning vane type sensor and an indicator in the cockpit were employed to detect horizontal gust activity. The teledyne stall warning transmitter can be used as a sideslip sensor. The following parameters are computed: sideslip angle, indicated air speed, magnetic heading, altitude, rudder position, elevator position, roll angle, and slat position. E A K.

N83-17467# Flow Application Research, Fremont, Calif.
TURBINE ENGINE FUEL CONSERVATION BY FAN AND COMPRESSOR PROFILE CONTROL

W B. ROBERTS and W ROGERS (Rogers-Dierks, Inc.) /in DOE Symp. on Com. Aviation Energy Conserv Strategies p 231-258 Apr 1981
Avail: NTIS HC A17/MF A01 CSCL 01B

The control of the compressor blade shapes which can provide fuel savings was examined. The blade shapes become distorted due to erosion which causes an aerodynamic performance deterioration and increases fuel consumption. Refurbished and new blades are at fuel consumption to near new engine values. Reconditioned blades which are sorted, reshaped and matched allow a superior recovery of fuel efficiency without the need for new blades. New blades, upon being put into service, can greatly benefit from being sorted, reshaped, and matched to allow full performance potential to be realized. The first stage fan blade is most critical, since it operates in a high erosion environment at supercritical aerodynamic conditions, while consuming more power than any other single blade. It is shown that fan and compressor blade shape control can lower fuel burn as much as 2-2 1/2% compared to standard refurbishment which leads to a significant fuel savings if implemented on a fleet wide basis. It is suggested that all aviation gas turbine engines would benefit from fan and compressor blade profile control. E A K.

N83-17468# Eastern Air Lines, Inc., Atlanta, Ga
A PRACTICAL ECONOMIC CRITERION FOR FUEL CONSERVATION

D R. FERGUSON /in DOE Symp. on Com. Aviation Energy Conserv. Strategies p 259-280 Apr 1981
Avail: NTIS HC A17/MF A01 CSCL 01B

A method to determine the value of time to input into the least cost method of computer flight planning that will optimize the fuel time tradeoffs available over the planning time horizon is proposed. Fuel can be saved by flying the aircraft at slower speeds, however, there is an economic penalty in pursuing this policy to its ultimate limit. No policy decision can possibly encompass all the variables of temperature, wind, wind gradients and payload encountered by the thousands of flights operations. The computer flight plan systems to optimize each flight for the variables of wind, wind gradient, temperature and payload, but can not resolve the value of time to use that allows the computer to optimize each flight consistently and correctly. E A K.

N83-17673# Exxon Research and Engineering Co., Florham Park, N.J

EDS COAL-LIQUEFACTION PROCESS DEVELOPMENT. PHASE 5: EDS ENVIRONMENTAL PROGRAM Interim Report

Nov 1981 89 p refs Sponsored in part by Exxon Co., Electric Power Research Inst., Japan Coal Liquefaction Development Co., Phillips Coal Co., ARCO Coal Co., Ruhrkohle AG, and Agip, S p A

(Contract DE-FC01-77ET-10069)

(DE82-005641, DOE/ET-10069/T11, FE-2893-79) Avail: NTIS HC A05/MF A01

This report describes the environmental activities being conducted to support the commercialization of the Exxon Donor Solvent Process (EDS). The EDS process involves the noncatalytic hydrolquefaction of coal at operating conditions of approximately 800 F and 2000 psia to produce a product slate of coal derived hydrocarbon liquids and gases compatible with current uses of natural petroleum. While there are no absolute environmental barriers to the successful commercialization of the EDS process under existing Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA) or other agency regulations, concerns do exist which include health and safety implications of uncharacterized process materials and emissions, potential environmental impact of product combustion, and safe disposal of uncharacterized solid wastes. These health/environmental concerns are being addressed within the EDS project for those materials which represent components of the EDS process development. DOE

N83-17731# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.

THE SECOND CONFERENCE ON THE ENVIRONMENTAL CHEMISTRY OF HYDRAZINE FUELS Final Report

W D CHRISTENSEN, R F HUDSON, and S LEWIS Apr. 1982 179 p refs Conf held at Tyndall AFB, Fla., 15 Feb. 1979 (Contract AF PROJ 1900)

(AD-A121324, AFESC/ESL-TR-82-22) Avail NTIS HC A09/MF A01 CSCL 21D

On 15 February 1979, the AF Engineering and Services Laboratory, AFESC, Tyndall AFB, Florida, hosted a conference on the environmental chemistry of the hydrazine fuels. Ten papers were presented on various subtopics, which were: (A) Environmental Impact and Assessment of Hydrazine Fuel Usage (B) Environmental Toxicology (C) Environmental Monitoring and Disposal of Hydrazines (D) Environmental Modeling and Chemistry of Hydrazine. The subtitles reflect a wide range of subjects. In Section A the use of H-70 (70 percent hydrazine) in the emergency power unit of the F-16, hydrazine on the space shuttle, and a fuel transportation risk analysis were discussed; in Section B, the toxicity of the hydrazines to selected bacteria and other organisms. This was followed by monitoring of hydrazine fuels vapor by chemiluminescence, and waste disposal by ozonation and chlorinolysis. The conference finished with a presentation on hydrazine spill modeling with estimations of hazard corridors and a summary of environmental physical-chemical properties of the hydrazine fuels. Author (GRA)

N83-17750# California Univ., Berkeley Lawrence Berkeley Lab Energy and Environment Div
RESIDENTIAL ENERGY DEMAND MODELING: IMPROVEMENTS TO THE ORNL MODEL

J E MCMAHON Oct 1981 11 p refs Presented at the Intern Conf on Energy Use Management (ICEUM 3), Berlin, 26-30 Oct 1981

(Contract W-7405-ENG-48)

(DE82-004925, LBL-12860, CONF-811006-9) Avail NTIS HC A02/MF A01

The ORNL/LBL Residential Energy Demand Model incorporated major improvements in three areas: efficiency of appliances, current construction practice in new houses, and appliance retirements. The new methodology is more general, and provides energy demand estimates in better agreement with recent data. Key areas for future improvements are indicated, including quantifying the uncertainty in model simulation, redefining the set of end uses, updating the algorithm, and broadening the model's applicability to different geographic areas. A US Department of Energy survey of appliance manufacturers was used to determine new appliance efficiencies. Similarly, surveys of current housing practices (e.g., ceiling insulation level) were used to estimate changes in heating and cooling energy requirements. Appliances are assumed to retire as a function of their age. DOE

N83-17824# Total Environmental Action, Inc., Harrisville, NH
RESIDENTIAL-APPLIANCE LOAD CHARACTERISTICS

J KOHLER Apr 1982 75 p

(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)

(DE82-012883, SERI/TR-11095-1) Avail NTIS HC A04/MF A01

The performance of residential photovoltaic systems in combination with energy efficient appliances is examined. The load characteristics are presented for several types of major residential appliances. Load characteristics consist of the average energy use of each appliance, the power demand while the appliance is operating, and a typical use schedule. Potential energy conserving features are investigated for each appliance and used to identify a best available model and maximum feasible energy efficient appliance. Load characteristics of these energy conserving designs are then compared with the load characteristics of a standard model. The feasibility of converting appliances to dc power for use with photovoltaic systems is also discussed. DOE

N83-17840# Steinmueller (L und C) GmbH, Gummersbach (West Germany) Fachbereich Umwelttechnik

DEVELOPMENT OF HEAT EXCHANGERS FOR REHEATING SCRUBBED FLUE GAS IN A PILOT PLANT Final Report, Jun. 1981

S MICHALAK Bonn Bundesministerium fuer Forschung und Technologie Sep 1982 89 p In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-82-169; ISSN-0340-7608) Avail NTIS HC A05/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 18,50

Application of some reheating systems in flue gas desulphurization plants was studied. The following problems are examined: the influence of solid impurities in gas on the heat transfer coefficient, the different operational conditions to test clearing of the heat transfer surface, the rate of corrosion, and the partial gas recirculation. Measurements to increase the heat transfer coefficient and removing of liquid drops are suggested. Measurement techniques, insulation and prevention of leakage are discussed. EAK

N83-17841# STEAG A.G., Essen (West Germany) Research and Development Dept

TESTING OF HEAT EXCHANGER SYSTEMS FOR REHEATING FLUE GASES FROM WET SCRUBBING DESULFURIZATION PLANTS Final Report, Dec. 1980

K THAN Bonn Bundesministerium fuer Forschung und Technologie Sep 1982 128 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with Vereinigte Elektrizitaetswerke Westfalen AG

(BMFT-FB-T-82-170, ISSN-0340-7608) Avail NTIS HC A07/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 27

Two heat exchanger systems: the cyclic process of GEA and the plate heat exchanger of Kahlitz/Thyssen, for reheating flue gases, which have been cooled to about 50 to 55 C due to wet scrubbing, to the required temperature at the outlet of the stack by extracting the sensible heat of the hot flue gases were tested. The problem of building materials and on keeping clean the heat exchanger surface are emphasized. EAK

N83-17842# Essen Univ (West Germany) Inst fuer Energie- und Kraftwerkstechnik

PRACTICAL AND THEORETICAL ANALYSIS OF CONTINUOUS SELECTION OF TEMPERATURE LAYERS IN A HOT TANK BY AN EXPERIMENTAL TANK AND A SIMULATION MODEL Final Report, Aug. 1981

M PATIL and P WENSIEWSKI Bonn Bundesministerium fuer Forschung und Technologie Sep 1982 161 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-82-171, ISSN-0340-7608) Avail NTIS HC A08/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DN 32,50

The stabilization and the behavior of stratifications were investigated and experimental data were recorded. In a hot water tank with special moving fixtures for charging and discharging, which control the thermal stratifications intentionally and continuously. The dynamic performance of such a type of storage tank for a conventional tank, for which a computer calculating model were developed. The limitations of using these stratifications in such storage tanks for space heating and hot water preparation are shown. Advantages and disadvantages of stratified tanks with continuous control are compared with those of conventional tanks. The results are documented with the help of diagrams and tables. EAK

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-17847# Oak Ridge National Lab., Tenn. Energy Div.
STEAM EJECTOR AS AN INDUSTRIAL HEAT PUMP
H G ARNOLD, W R HUNTLEY, and H PEREZ-BLANCO
1982 28 p refs Presented at the Semiann. Meeting of
ASHRAE, Houston, Tex., 24-28 Jan. 1982
(Contract W-7405-ENG-26)
(DE82-010194; CONF-820112-8) Avail. NTIS HC A03/MF A01

The steam ejector is analyzed for use in industrial heat recovery applications and compared to mechanical compressor heat pumps. An estimated ejector performance was analyzed using methods based on conservation of mass, momentum, and energy, using steam properties to account for continuity; and using appropriate efficiencies for the nozzle and diffuse performance within the ejector. A potential heat pump application at a paper plant in which waste water was available in a hot well downstream of the paper machine was used to describe use of the steam ejector. Both mechanical compression and jet ejector heat pumps were evaluated for recompression of flashed steam from the hot well. It is noted that another possible application of vapor recompression heat pumps is the recovery of waste heat from large facilities such as the gaseous diffusion plants. The economics of recovering waste heat in similar applications is analyzed. DOE

N83-17886# Alberta Univ., Edmonton.
RATIONALE FOR ADVANCES IN THE TECHNOLOGY OF I.C. ENGINES
J D DALE and A K OPPENHEIM (California Univ., Lawrence Berkeley Lab., Berkeley) Aug. 1981 48 p refs Presented at the Soc. of Auto Engr Intern Congr. and Expo., Detroit, 22-26 Feb. 1982
(Contract W-7405-ENG-48)
(DE82-000264; LBL-13179, CONF-820203-1) Avail. NTIS HC A03/MF A01

The advantages of the new constraints of I.C. engines, pollution control and fuel economy requirements, by further advances in engine technology, designed to minimize pollutant emissions, maximize engine efficiency, and optimize tolerance to a wider variety of fuels are discussed. The fundamental advantages of reciprocating I.C. engines as prime movers for automobiles are assessed. Controlled combustion is based upon a proper treatment of active radicals, the essential elements of the combustion reaction. This can be achieved by a variety of means, such as charge stratification, exhaust gas recirculation, homogeneous lean burn, combined with enhanced ignition and enhanced autocatalysis. It is concluded that the most desirable advances in engine technology would transfer a good deal of the functions served by catalytic converters and electronic controls into the chemistry and mechanics of combustion processes taking place in the engine cylinder. DOE

N83-17889# Alberta Univ., Edmonton
A RATIONALE FOR ADVANCES IN THE TECHNOLOGY OF I.C. ENGINES
J D DALE and A K OPPENHEIM (California Univ., Berkeley, Lawrence Berkeley Lab.) Nov. 1981 51 p refs Presented at the 1982 SAE Intern Congr. and Exposition, Detroit, 22-26 Feb. 1982
(Contract W-7405-ENG-48)
(DE82-005840; LBL-13179-REV, CONF-820203-2) Avail. NTIS HC A04/MF A01

Internal combustion (I.C.) engines are required to meet demands for improved air pollution control and greater fuel economy. These demands were met by peripheral engine system improvements such as catalytic converters and electronic controls. It is proposed that the most desirable advances in engine technology transfer the functions of catalytic converters and electronic controls into the chemistry and mechanics of combustion processes taking place within the engine cylinders, and that advances in controlled combustion technology results in minimum pollutant emissions, maximum engine efficiency, and optimum tolerance for a wider variety of engine fuels. DOE

N83-18017 Department of Energy (US), London (England)
DEVELOPMENT OF THE OIL AND GAS RESOURCES OF THE UNITED KINGDOM. A REPORT TO PARLIAMENT BY THE SECRETARY OF STATE FOR ENERGY Annual Report, 1982
Apr. 1982 69 p refs Original contains color illustrations
(ISBN-0-11-411123-5) Avail. Issuing Activity

The development of the oil and gas resources of the United Kingdom is described and estimates of oil and gas reserves on the United Kingdom continental shelf are given. Exploration, production and operational aspects, and economic and industrial impacts are addressed. M.G.

N83-18018 Department of Energy (US), London (England)
ADVISORY COUNCIL ON ENERGY CONSERVATION. REPORT TO THE SECRETARY OF STATE FOR ENERGY.

1982 39 p refs
(EP-49, ISSN-0-11-411122-7) Avail. HMSO 3 70 PHI

An assessment is given of energy conservation measures in the United Kingdom. It is concluded that significant progress was made and that the strongest and most necessary part of any energy conservation program is energy pricing on the basis of true long run replacement costs. Domestic, industrial, and transportation energy are discussed. The role of controls and energy management systems are discussed. Hot water heating, thermal insulation, and heating systems are also discussed. R.J.F.

N83-18019 Department of Energy (US), London (England)
Statistical Service Dept.
DIGEST OF UNITED KINGDOM ENERGY STATISTICS, 1982
1982 125 p refs
(ISBN-0-11-411124-3) Avail. HMSO, 11 50 PHI

United Kingdom energy statistics are given. General energy statistics and tables showing each fuel in original units of measurement, in coal equivalent, in oil equivalent and in terms of the thermal content of fuel are given. The estimated value of purchases of fuels, energy consumption by final users and an analysis of energy consumption by main industrial groups are given. Charts showing the trends of primary fuel consumption and demand by final consumers of energy are given. Individual fuels, prices and values of fuels and foreign trade in fuels are listed. R.J.F.

N83-18020 Department of Energy (US), London (England) Energy Technology Support Unit
THE IRON AND STEEL INDUSTRY. ENERGY CONSUMPTION AND CONSERVATION IN THE IRON AND STEEL INDUSTRY
P B TAYLOR Apr. 1982 157 p refs Prepared in cooperation with Dept. of Industry, London. Original contains color illustrations
(ENERGY-AUDIT-SER-16) Avail. Issuing Activity

The consumption of energy by the industry as a whole is considered. The individual manufacturing processes are examined with particular emphasis being placed upon important energy losses. These data are then collated into an overall energy flow diagram for the industry in addition to a description of the plant destinations of the various fuel types. Energy flows and cost effective energy conservation in the basic unit manufacturing processes of the industry are emphasized. S.L.

N83-18021 International Inst. for Applied Systems Analysis, Laxenburg (Austria)
TWO GLOBAL SCENARIOS: THE EVOLUTION OF ENERGY USE AND THE ECONOMY TO 2030
V. G. CHANT Nov. 1981 83 p refs
(IIASA-RR-81-35, ISBN-3-7045-0026-7) Avail. Issuing Activity

Energy in a Finite World. A Global Systems Analysis (Ballinger, Cambridge, Massachusetts, 181, 880 pages) documents the seven-year study of the future balance of energy supply and demand made by the IIASA Energy Systems Program. Part IV of this book, Balancing Supply and Demand: The Quantitative Analysis, presents results based on two scenarios of global and regional development. Based on the data available when the work was done, these scenarios specify population growth, aggregate

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

economic development in five sectors, and detailed energy use and supply for seven global regions. The scenarios specify energy requirements for households, transportation, and economic activity, and estimate energy supply regionally and globally. These scenario projections are described and analyzed within the economic framework, including aggregate economic models, that was used in deriving the projections. To understand the context of this report and to appreciate the full range of its findings, one must read it in conjunction with the book cited above. ESA

N83-18026# Krupp Stahl A G., Bochum (West Germany)
Hauptbereich Energiewirtschaft

UTILIZATION OF INDUSTRIAL WASTE HEAT, CITING AN INTEGRATED IRON AND STEEL WORKS AS AN EXAMPLE TO SAVE PRIMARY ENERGY AND TO REDUCE THE BURDEN ON THE ENVIRONMENT, VOLUME 1 Final Report, Dec. 1980

H G POETTKEN and H. STROHSCHNEIN Bonn
Bundesministerium fuer Forschung und Technologie Aug 1982
488 p refs In GERMAN, ENGLISH summary Sponsored by
Bundesministerium fuer Forschung und Technologie 2 Vol.
(BMFT-FB-T-82-151-VOL-1; ISSN-0340-7608) Avail NTIS HC
A21/MF A01; Fachinformationszentrum, Karlsruhe, West
Germany DM 76,50

The utilization of waste heat to substitute primary energy is an essential factor to complement the savings of primary energy achieved by changes in the design of industrial plant and processes. The potential for waste energy utilization in an integrated iron and steel works were investigated in technical and economic terms. It is found that possibilities for utilizing such energy always obtain when waste energy is produced fairly continuously at an appreciable temperature level and in adequate quantity. Economic analysis shows that with present day energy prices it is only a question of time before the recovery of waste energy, which is technically feasible, becomes feasible. E.A.K.

N83-18027# Krupp Stahl A G., Bochum (West Germany).
Hauptbereich Energiewirtschaft

UTILIZATION OF INDUSTRIAL WASTE HEAT, CITING AN INTEGRATED IRON AND STEEL WORKS AS AN EXAMPLE TO SAVE PRIMARY ENERGY AND TO REDUCE THE BURDEN ON THE ENVIRONMENT, VOLUME 2 Final Report, Dec. 1980

H G. POETTKEN and H. STROHSCHNEIN Bonn
Bundesministerium fuer Forschung und Technologie Aug. 1982
116 p refs In GERMAN, ENGLISH summary Sponsored by
Bundesministerium fuer Forschung und Technologie 2 Vol
(BMFT-FB-T-82-151-VOL-2; ISSN-0340-7608) Avail. NTIS HC
A06/MF A01, Fachinformationszentrum, Karlsruhe, West
Germany DM 76,50

The potential of waste energy utilization in an integrated iron and steel works were investigated in technical and economic terms. The utilization of waste heat to substitute primary energy is an essential factor to complement the savings of primary energy achieved by changes in the design of industrial plant and processes. It is found that possibilities for utilizing such energy is obtained when waste energy is produced fairly continuously at an appreciable temperature level and in adequate quantity. Economic analysis shows that with present day energy prices the recovery of waste energy is only a question of time which is technically feasible and becomes an economic proposition. The increasing use of waste energy in the steel industry or elsewhere is no alternative to the expansion of other energy producing facilities. E.A.K.

N83-18035# North Carolina Agricultural and Technical State Univ., Greensboro. School of Engineering.

RENEWABLE ENERGY SYSTEM FEASIBILITY STUDY Final Report, 2 Sep. 1980 - 30 Apr. 1982

D. E. KLETT, D. Y. GOSWAMI, D. E. OLSON, and E. K. STEFANAKOS Wright-Patterson AFB, Ohio AFWAL Aug 1982 102 p refs
(Contract F33615-80-K-3626, AF PROJ. 2404)
(AD-A121252; AFWAL-TR-82-3050) Avail NTIS HC A06/MF
A01 CSCL 10B

A study was performed to determine the economic feasibility of displacing a portion of the electrical energy usage at the Wind tunnel Complex at WPAFB by a renewable energy system. Wind systems, photovoltaic systems and solar thermal systems evaluated using lifecycle cost analysis. Economic feasibility was not found for any of the systems evaluated. Author (GRA)

N83-18036# Notre Dame Univ., Ind Dept of Aerospace and Mechanical Engineering.

ENERGY CONSERVATION IN ELECTROSTATIC FABRIC FILTRATION OF INDUSTRIAL DUST Final Report

T. ARIMAN Dec 1981 63 p refs
(Contract DE-AS02-77CS-40051, EC-77-S-2-4428)
(DE82-006897; DOE/CS-40051/1) Avail NTIS HC A04/MF
A01

An external electric field was utilized in the industrial dust control by fabric filters with very promising initial results. A substantial decrease in the pressure drop and an increase in collection efficiency were observed. The detailed outcome of the experimental research program in electrostatic fabric filtration is presented. The results show that pressure drop decreases substantially with the increased electrostatic field strength for all relevant parameters. Furthermore, the data of the experimental program was utilized to develop a semi-empirical model for the determination of the pressure drop and to establish an energy-optimized design criteria. DOE

N83-18037# New Mexico Univ., Albuquerque Dept of Mechanical Engineering

POTENTIAL FOR DOMESTIC HEAT RECOVERY Final Report, 1 Jan. - 31 Dec. 1980

K. T. FELDMAN, JR and G. J. TSAI Nov 1981 73 p refs
(DE82-901395; NP-2901395, EMD-2-68-1106;
ME-112(81)EMD-870-1) Avail. NTIS HC A04/MF A01

The potential for reducing gas-fired heating costs by the use of waste heat is discussed. A heat recovery heat exchanger can be installed to recover waste heat from the hot exhaust gases going up the flue pipe from a furnace, water heater, or clothes dryer. Some specific designs are described for heat recovery equipment. Specific design and performance of the Hallowin heat exchanger and the heat pipe heat exchanger are evaluated. DOE

N83-18038# Idaho National Engineering Lab., Idaho Falls.

OPPORTUNITIES FOR DIRECT-CONTACT WASTE HEAT RECUPERATORS FOR INDUSTRIAL HEAT RECOVERY

S. L. RICHLEN and T. T. SEMLER 1981 7 p refs Presented at the IECEC Conf., Atlanta, 9 Aug 1981
(Contract DE-AC07-76ID-01570)

(DE82-006280, CONF-810812-40) Avail NTIS HC A02/MF A01

The potential industrial applications of the direct-contact waste heat recuperator (DCWHR) for the 353 K to 672 K temperature range were identified. The DCWHR increases the heat transfer area per unit volume over typical heat exchangers, and holds promise for latent heat recovery from waste streams. Results show that, for selected industrial waste heat sources, the production of hot process water by direct-contact heat exchange can be economically accomplished for waste heat (hot gas) streams at 478 K to 672 K with greater than 4.72 cu m/sec exhaust. Additionally, a DCWHR is particularly recommended for particulate-laden exhaust streams where scrubbing is already required by environmental consideration, the recovered heat becomes a factor in reducing the negative cash flow attributable

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

to the use of scrubbing equipment Incentives and obstacles to early market penetration of the technology are recognized DOE

N83-18039# Massachusetts Inst of Tech, Cambridge System Dynamics Group

THE ENERGY TRANSITION AND THE MACROECONOMY: A FRAMEWORK FOR POLICY ANALYSIS Final Report

J D STERMAN Dec 1981 668 p refs

(Contract DE-AC02-80PE-70228)

(DE82-007839, DOE/PE-70228/1) Avail NTIS HC A99/MF A01

An integrating framework designed to evaluate the effects of depletion and rising energy prices on economic growth, inflation, and other key economic and energy indicators over the time frame 1980 to 2050 is discussed. The framework provides a general disequilibrium representation of the major linkages between the energy sector and the economy. Gross national product, consumption, investment, wages and prices, and other major energy and economic aggregates are determined endogenously. Though the framework generates the macroeconomic dynamics of the economy, it is based on an explicitly behavioral theory of economic decision-making at the microeconomic level of individuals and firms. Results show a substantial potential for the first-order effects of depletion (rising capital requirements for energy production, rising real energy prices) to be amplified by feedback mechanisms in the economy, worsening economic performance DOE

N83-18040# Los Alamos Scientific Lab, N Mex

A DATA-GATHERING METHOD FOR USE IN MODELING ENERGY RESEARCH, DEVELOPMENT AND DEMONSTRATION PROGRAMS

M A MEYER, J M BOOKER, H S CULLINGFORD, and A T PEASLEE, JR 1981 11 p refs Presented at the 4th Intern Conf. on Alternative Energy Sources, Miami Beach, Fla, 14-16 Dec 1981

(Contract W-7405-ENG-36)

(DE82-006153, LA-UR-81-3619, CONF-811212-8) Avail NTIS HC A02/MF A01

The development and testing of a data-gathering method for use in a computer program designed to model energy research, development, and demonstration programs for decisionmakers are described. The data-gathering method consists of face-to-face interviews with the scientists working on the projects that will be modeled by the computer program. The basic information gained from an interview includes time estimates for reaching certain project goals and the probability of achieving those goals within the times estimated. The interview method is based on decision analysis techniques. The Magnetic Fusion Energy program of the US Department of Energy was selected as the test case. The data gathering method was used at five fusion projects to determine whether it could meet its design criteria. Extensive statistical analysis was performed to learn how much the expert's answers agreed, what factors were likely to enter into their estimates, and how their estimates corresponded DOE

N83-18041# Tufts Univ., Medford, Mass.

THE NEW ENGLAND ENERGY CONGRESS PROJECT Final Report, Jun. 1978 - Jul. 1980

20 Nov 1981 58 p refs

(Contract DE-AC02-78EV-10131)

(DE82-005521, DOE/EV-10131/8) Avail NTIS HC A04/MF A01

The Energy Congress' activities, consensus decision-making process and its findings are discussed. The results of a thorough evaluation conducted through the mail and by phone of participants, outside observers and from Capital Hill are given. The clear conclusion is that the Energy Congress made a unique and significant contribution towards enabling New Englanders, both in the region and in Washington, to set energy goals and priorities and to begin serious efforts to reduce the region's precarious dependence on oil imports DOE

N83-18042# Los Alamos Scientific Lab, N Mex

THE PROMISE AND STATUS OF INTERNATIONAL APPLICATIONS OF PHOTOVOLTAICS

J H ALTSEIMER and M C KRUPKA 1981 25 p refs Presented at the 4th Intern Conf on Alternative Energy Sources, Miami Beach, Fla, 14 Dec 1981

(Contract W-7405-ENG-36)

(DE82-006152, LA-UR-81-3641, CONF-811212-7) Avail NTIS HC A02/MF A01

Substantial marketing opportunities for selected PV applications, despite high costs exist mostly in the developing nations. The Ivory Coast, Mexico, and the Republic of South Africa were reviewed for their potential as PV consumers. The US, France, West Germany, and Japan are the major industrial nations conducting research, development and commercialization programs on PV. At least twelve other countries are involved to a lesser degree. In technology, the US is ahead but the programs and the progress in the other three major countries are nevertheless significant. Japan is also developing its own technology base and systems and may soon decide to become more active in the market place. Federal funding in the US for PV is being drastically reduced. Governmental funding in the other three major nations is relatively strong and appears to be growing DOE

N83-18051# Charles River Associates, Inc, Boston, Mass

ANALYTICAL AND POLICY ISSUES IN ENERGY ECONOMICS: USES OF THE FRS DATA BASE

Dec 1981 99 p refs

(Contract DE-AC01-81EI-10752)

(DE82-004258, CRA-591) Avail NTIS HC A05/MF A01

The relevant literature concerning several major analytical and policy issues in energy economics is reviewed and criticized. The possible uses of the Financial Reporting System (FRS) data base for the analysis of energy policy issues are investigated. Certain features of FRS data suggest several ways in which the data base can be used by policy makers. FRS data are collected on the firm level, and different segments of the same firm operating in different markets can be separately identified. The methods of collection as well as FRS's elaborate data verification process guarantee a high degree of accuracy and consistency among firms DOE

N83-18054# Pacific Northwest Lab, Richland, Wash

NEW PRIORITIES IN ENERGY-CONSERVATION RESEARCH AND DEVELOPMENT

T L WILLKE, W B ASHTON, W J HOPP, G J HANE, A LIBERMAN, and G STRASSER (Strasser Assoc, Inc) Dec 1981 22 p refs

Presented at the 4th Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla, 14 Dec 1981

(Contract DE-AC06-76RL-01830)

(DE82-005988, PNL-SA-10072, CONF-811212-13) Avail NTIS HC A02/MF A01

Information on various technologies which offer significant potential for energy conservation yet require applied research and development to achieve that potential are discussed. The scope and the methodology used to identify and screen energy conservation research and development (R and D) opportunities are discussed. Results of the R and D opportunities study are discussed, including a tabular summary of conservation potential and example R and D needs. General aspects of the new energy policy and its effects on the federal role in energy conservation are discussed. The potential effects of the new energy policy upon areas of applied R and D identified under previous criteria are illustrated and elements of the new federal role in energy conservation are summarized DOE

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-18055# Oak Ridge National Lab, Tenn Metals and Ceramics Div

INVESTIGATION OF ATTIC-INSULATION EFFECTIVENESS USING ACTUAL ENERGY-CONSUMPTION DATA

T F SCANLAN, C K BAYNE, and D R. JOHNSON 1981 24 p Presented at the Energy Conserv in the 80's Conf, Clearwater, Fla, 8 Dec 1981

(Contract W-7405-ENG-26)

(DE82-006822, CONF-811222-1) Avail NTIS HC A02/MF A01

Investigators determined the effectiveness of attic insulation using actual energy consumption and weather data for 34 single family residences in the Knoxville, Tennessee area. For each residence, linear regression techniques were used to determine the actual winter energy consumption rates for 2 years before and 3 years after the installation of attic insulation. Comparison of the pre and post installation energy consumption rates confirmed, in all but a few cases, the effectiveness of attic insulation. The agreement between predicted and actual consumption rates is also addressed.

DOE

N83-18060# Argonne National Lab, Ill Academy for Contemporary Problems

THE COMPREHENSIVE COMMUNITY ENERGY MANAGEMENT PROGRAM: AN EVALUATION

J L MOORE, D A BERGER, H M GRIGGS, and C B RUBIN Dec 1981 374 p

(Contract W-31-109-ENG-38)

(DE82-011552, ANL/CNSV-TM-89) Avail NTIS HC A16/MF A01

A comprehensive community energy management program (CEMP) in communities was developed to facilitate comprehensive community energy management through dissemination of methodologies and the results of applying these methodologies. Information for federal policy related to CCEMP was also developed. A synthesis of insights gained from the community experiences is provided. Approaches and topics in evaluating the pilot program, and the background and methodology of community energy planning are discussed. The factors contributing to different plant outcomes, providing an overall synthesis and program evaluation are examined. Detailed action plans for ten cities, three counties, and three regions are given.

DOE

N83-18064# Geothermal Development Associates, Reno, Nev
A PRELIMINARY PLAN FOR THE DEVELOPMENT OF GEOTHERMAL ENERGY IN THE TOWN OF GABBS, NEVADA

9 Nov 1981 111 p refs

(Contract DE-FC03-80RA-50075)

(DE82-007602, DOE/RA-50075/T5) Avail NTIS HC A06/MF A01

Characteristics of the site significant to the prospect for geothermal development are described. These characteristics include physiography, demography, economy, and the goals and objectives of the citizens as they would relate to geothermal development. The geothermal resource evaluation is described. The reservoir is described in general defining the depth to the reservoir, production rates of the existing water wells, water quality, and the resource temperature. Uses of the energy that seem appropriate to the situation both now and in the foreseeable future consumed, by end-user, are estimated. A conceptual engineering design and cost estimates are presented. The results of a life cycle analysis of the economic feasibility are discussed. The essential institutional requirements for geothermal energy development are discussed.

DOE

N83-18065# Geothermal Development Associates, Reno, Nev
A PRELIMINARY PLAN FOR THE DEVELOPMENT OF GEOTHERMAL ENERGY IN THE TOWN OF HAWTHORNE, NEVADA

4 Nov 1981 123 p refs

(Contract DE-FC03-80RA-50075)

(DE82-007594, DOE/RA-50075/T6) Avail NTIS HC A06/MF A01

The development of the geothermal resource were analyzed. Site characteristics pertinent to the geothermal development are described. The probable drilling depth to the reservoir, anticipated water production rates, water quality, and resource temperatures are indicated. Uses of the energy appropriate to the situation are described. The amounts and types of energy currently consumed by end users are estimated. Conceptual engineering designs and cost estimates for three alternative district heating systems are presented. The results of a life cycle cost analysis for these alternatives are discussed. The essential institutional requirements for geothermal energy development, including the financial, environmental, and legal and regulatory aspects are discussed. The various steps necessary to accomplish the construction of the geothermal district heating system at Hawthorne are described.

DOE

N83-18067# Pacific Northwest Lab, Richland, Wash
COMMERCIAL BUILDING DESIGN AND ENERGY CONSERVATION: A PRELIMINARY ASSESSMENT

A. L. NIEVES and D. ROSOFF Feb. 1982 13 p Presented at the 9th Energy Technol Conf, Washington, 16 Feb 1982

(Contract DE-AC06-76RL-01830)

(DE82-008581, PNL-SA-10230, CONF-820217-2) Avail NTIS HC A02/MF A01

The purpose of the research was to determine the degree of change in commercial building design practice relating to energy conservation since the enactment of the Energy Conservation Standard for New Buildings Act of 1976. Data on current design practices consisted of information from 400 buildings advertised for bids or under construction in 1979 to 1980 on glass in windows and doors, exterior wall systems, roof system, heating plants, and lighting systems. In addition to these building design components, energy conservation measures used included natural lighting, deadband thermostat, greenhouse-effect atrium collector, heat recovery from the top of the atrium, greenhouse passive heating panels, natural ventilation, insulating shutters, closable skylights, thermal shutters, Trombe wall, corridor trombe, attic ventilation, wind shielding, concrete wall; tilted windows, night flushing cycle, and cooling coils using cooling tower water. A brief explanation of these measures is given.

DOE

N83-18068# Southern Solar Energy Center, Inc., Atlanta, Ga
ENERGY CONSIDERATIONS: MOBILE HOMES IN THE SOUTH

G R TILT Nov 1981 22 p refs

(Contract DE-AC02-79CS-30166)

(DE82-009586, SSEC/SP-32288) Avail NTIS HC A02/MF A01

Mobile homes in the Southern region are discussed and their relationship to residential energy conservation is examined. Research being done in energy conservation and solar energy applications for manufactured houses is examined. A bibliography is included.

DOE

N83-18076# Los Alamos Scientific Lab, N Mex
ENERGY DEVELOPMENT ON NATIVE AMERICAN LANDS: RESOURCES AND ATTITUDES. AN INTERPRETIVE REPORT ON TWO MAJOR INDIAN CONFERENCES OF 1980

F J LUCERO, JR Feb 1982 34 p refs

(Contract W-7405-ENG-36)

(DE82-009539, LA-9218-MS) Avail NTIS HC A03/MF A01

Energy resources (oil, gas, coal, uranium) on Indian lands are assessed and an analysis of Indian attitudes toward energy development on their land is made. An examination is made of how Indians think their governments ought to operate; specific Indian religious and social attitudes towards energy development are explored. Current litigation in taxation, Federal regulation of

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

Indian mineral development, Federal environmental standards, and Indian water-rights disputes are discussed DOE

N83-18077# Southern Solar Energy Center, Inc., Atlanta, Ga.
DEVELOPMENT OF RESIDENTIAL-CONSERVATION-SURVEY METHODOLOGY FOR THE US AIR FORCE. TASK 2 Interim Report

D W. ABRAMS, T. L. HARTMAN, and A S LAU 13 Nov. 1981
132 p
(Contract DE-AC02-79CS-30166)

(DE82-009473, SSEC/TP-412832) Avail NTIS HC A07/MF A01

A residential energy conservation methodology was developed to compare USAF needs and procedures of the residential conservation service (RCS) program developed by utility companies for serving civilian customers. Attention was given to the data implications related to group housing, climatic data requirements, life cycle cost analysis, energy saving modifications beyond those covered by RCS, and methods for utilizing existing energy consumption data in approaching the USAF survey program. The five subtasks of the program are summarized. Energy conservation alternatives are listed and the basic analysis techniques for evaluating thermal performance are described DOE

N83-18080# Los Alamos Scientific Lab., N. Mex
ENERGY SUPPLY AND DEMAND IN THE CARIBBEAN REGION, 1978-2000

C J. RUHM (California Univ.) Sep. 1982 65 p refs

(Contract W-7405-ENG-36)

(DE83-002312, LA-9526-MS) Avail NTIS HC A04/MF A01

Energy demand for countries in and bordering the Caribbean Ocean through the year 2000 is estimated. Forecasts, on a country by country basis, are formed using estimates for the gross domestic product growth rates, petroleum price increases, and income and price elasticities. Energy demand is generally concluded to rise during the forecast period, even with greater conservation efforts, but at a slower rate than in the past. The costs of imported energy are projected to increase faster than national incomes and in some cases may seriously adversely affect prospects for economic development. Energy demands are further projected on a sector by sector basis for Central American nations. These forecasts are consistent with results of the aggregated projections and indicate that for these countries, major efforts should be devoted towards reducing the transportation sector's demand for energy. DOE

N83-18081# California Univ., Livermore Lawrence Livermore Lab. Energy and Resource Planning Group.

US ENERGY FLOW, 1981

C K BRIGGS and I Y BORG 1 Oct 1982 19 p refs

(Contract W-7405-ENG-48)

(DE83-001579; UCID-19227-81) Avail NTIS HC A02/MF A01

Flow diagrams to describe the US energy situation are given. In 1981 the energy consumption was 73 quads (or 73 times 10 to the 15th power Btu). Use was down from 75 quads in 1980. Oil continues to dominate the picture as it comprises 45% of the total energy used. Net oil use (exclusive of oil purchased for the Strategic Petroleum Reserve and Exports) fell 8%, oil imports declined 14%. In contrast to oil, use of natural gas and coal remained at 1980 levels. Decreased use of residual oils, principally for electric power generating, account for much of the drop in oil use. Increased use of coal and nuclear energy for power generation almost compensated for the decrease in use of oil in that end use. Transmitted power remained at 1980 levels. The remainder of the drop in energy usage is attributed to price driven conservation, increased efficiencies in end use and the recession that prevailed during most of the year. The share of the energy drop attributable to the recession is estimated by various analysts to be on the order of 40 to 50% DOE

N83-18100# Los Alamos Scientific Lab., N. Mex
PROCEEDINGS OF THE WORKSHOP ON RADIOACTIVITY ASSOCIATED WITH COAL GAS

P WAGNER and N R GREINER Dec 1981 70 p refs
Workshop held in Santa Fe, N. Mex., 15-17 Sep 1981

(Contract W-7405-ENG-36)

(DE82-007880, LA-9106-C; CONF-8109115-SUMM) Avail NTIS HC A04/MF A01

Research issues associated with radioactivity resulting from the use of coal for electric power generation are discussed. The consensus was that a moderate to strong need exists for research in solubility of fly ash in different fluids and for determination of radioactivity in construction materials. Several additional research issues were identified but were given a lower priority. Some effects of coal combustion on the radiation environment; radionuclides in western coal at Mound; low level radiation in coals utilized and ashes produced at New York State electric utilities chemistry of radionuclides in coal preparation, uranium daughters in natural atmospheric aerosols and coal fired power plant emission, possible contributions of coal extraction and utilization to radioactivity contributions in drinking water, and impact on water quality from radionuclides in coal are among the topics discussed DOE

N83-18104# Oak Ridge National Lab., Tenn. Environmental Sciences Div
STATISTICAL DATABASE MANAGEMENT FOR ECOSYSTEM-EFFECTS ANALYSIS

J C GOYERT and K L DANIELS 1981 12 p Presented at the Workshop on Statist Data Base Management, Menlo Park, Calif., 2 Dec 1981

(Contract W-7405-ENG-26)

(DE82-005199, CONF-811208-4) Avail NTIS HC A02/MF A01

A team of scientists in the Environmental Sciences Division (ESD) at Oak Ridge National Laboratory has developed a multi-year study to estimate the environmental effects of a synthetic oil spill into lentic freshwater ecosystems. The toxicity of synthetic fuels was evaluated at three levels of increasing complexity, single species bioassays, laboratory microcosms, and outdoor pond ecosystems. A statistical database management system had to be developed that would organize, document, retrieve, and analyze the large amounts of data that were generated during the study. The potential problems anticipated in developing the database included (1) developing a logical file organization and documentation system, (2) designing consistent and unambiguous code sheets while satisfying the needs of different scientific investigators, and (3) creating and updating data files during the period of study. These problems were resolved DOE

N83-18108# Radian Corp., Sacramento, Calif.
IMPACT OF AIR POLLUTION CONTROL REGULATIONS ON THERMAL ENHANCED OIL RECOVERY PRODUCTION IN THE UNITED STATES Final Report

J. F. NORTON, J. D. ROUGE, P. K. BEEKLEY, S. N. HUSBAND, C. W. ARNOLD, W. R. MENZIE, and H. W. BALENTINE Mar 1982 293 p refs

(Contract DE-AC03-78SF-01863)

(DE82-011237, DOE/SF-01863/1) Avail NTIS HC A13/MF A01

The impact of air pollution control regulations on the costs of present and future thermal enhanced oil recovery (TEOR) production was assessed. It is indicated that lengthy permitting processes, limited control system availability, and costly control system requirements complicate regulatory compliance and constrain TEOR production expansion. Air pollution control rule and regulation requirements were determined for each production area. State-of-the-art air pollution control technology was assessed and costs were estimated for the control systems needed to comply with previous new source review (NSR) and retrofit rules in each area. Costs were calculated for the control systems required to allow the maximum increase in TEOR production. An air quality impact analysis was performed for the four largest production areas. The air quality changes associated with the maximum TEOR production increase and compliance with retrofit and NSR rules are estimated DOE

N83-18109# Massachusetts Inst. of Tech, Cambridge Energy Lab.

ESTIMATING POLLUTANT EXPOSURES FROM COAL FIRED POWER PLANTS IN A RURAL REGION

S BATTERMAN, M. SCHENKER, F SPEIZER, and J GRUHL
Dec 1981 37 p refs Prepared in cooperation with Harvard Medical School

(Contract DE-AM01-76EI-02295)

(DE82-008136, MIT-EL-81-047) Avail NTIS HC A03/MF A01

Aspects of air pollution exposure estimates which are relevant to epidemiologic studies are discussed. It is demonstrated that measures of air pollution exposures, once taken as a routine and trivial matter, are in fact as complex and important as other considerations in the epidemiological investigation. Biased or erroneous air pollution measures produce invalid exposure estimates as would any other incorrectly measured risk factor. The selection of the best pollution measure for an area is influenced by regional characteristics, such as terrain, meteorology, pollutant sources and monitor location. Lacking a standardized procedure, good judgement is essential in selecting pollutant measure for a particular study. Appropriate criteria for selecting a pollution measure are appropriateness and stability. Data from the monitoring of sulfur dioxide and total suspended particulate over a 5 year period are included. DOE

N83-18116# Colorado State Univ, Fort Collins

ENVIRONMENTAL RADIATION SURVEILLANCE PROGRAM Summary Report, Jul. - Dec. 1981

1981 146 p

(DE82-902009, NP-2902009) Avail NTIS HC A07/MF A01

The power generating record for the Fort St Vrain Nuclear Generating Station during the last half of 1981 is presented. The energy generation was slightly greater than during the first half of 1981 and the highest for any previous 6 month reporting period. Any correlation of radioactivity in environmental samples with the effluent release data is discussed. DOE

N83-18117# Sandia Labs, Albuquerque, N Mex

SITE SELECTION AND CHARACTERIZATION FOR AN UNDERGROUND COAL GASIFICATION TEST IN WASHINGTON STATE. VOLUME 2: PROJECT DETAILS Final Report

L. C BARTEL, comp and S. L. LOVE, comp Dec 1981 299 p refs 2 Vol

(Contract DE-AC04-76DP-00789)

(DE82-010948, SAND-81-2051/2) Avail NTIS HC A13/MF A01

Selection and characterization of a site suitable for an underground coal gasification (UCG) experiment was undertaken. A set of general criteria, based on previous UCG experience was used to screen potential sites. The Tono Basin in the Centralia Chehalis coal district, was selected for detailed characterization. The basin near the Centralia Steam Electric Generating Plant, and it contains a 47 foot thick seam of subbituminous coal at a depth of about 600 feet. Geothermal characterization of Tono was accomplished by using a combination of surface seismic surveys, surface electromagnetic surveys, borehole logging, coring, and hydrological testing. An environmental survey of the Tono Basin was also conducted. The results of the project have not disclosed any characteristics which would preclude conducting a gasification experiment in the Tono Basin. DOE

N83-18118# California Univ, Livermore Lawrence Livermore Lab.

CLEANUP OF GROUNDWATER CONTAMINATED BY UNDERGROUND COAL GASIFICATION

E RABER, R E THOMPSON (M O Schultz and Co), F H SMITH (National Technical Service, Inc), and V L DUVAL
1981 22 p refs Presented at the SPE Ann Tech Conf and Exhibition, San Antonio, 4-7 Oct 1981

(Contract W-7405-ENG-48)

(DE82-005824, UCRL-86502, CONF-811023-7) Avail NTIS HC A02/MF A01

Bench scale laboratory experiments confirmed the high adsorption capacity of bituminous activated carbon for the removal

(99.9%) of organic contaminants found in groundwaters associated with underground coal gasification (UCG) sites. Based upon recent laboratory and field interpretations, engineering designs are presented for the surface treatment of groundwater contaminated by UCG operations. A methodology is suggested for consideration of other unconventional in situ treatments. DOE

N83-18133# California Univ, Livermore Lawrence Livermore Lab

A BRIEF OVERVIEW OF GEOPHYSICAL PROBING TECHNOLOGY

A L RAMIREZ and R J LYTLE 1 Feb 1982 20 p refs

(Contract W-7405-ENG-48)

(DE82-011217, UCID-19308) Avail NTIS HC A02/MF A01

High-resolution geophysical techniques which can be used to characterize a nuclear waste disposal site were evaluated. The current capabilities and limitations of geophysical methods used for site selection are considered. The capabilities and limitations associated with this technology are reviewed. Both seismic and electromagnetic techniques to obtain high resolution information are examined. The usefulness of geotomography in mapping fracture zones remotely is assessed, core samples are collected to assess the capability of correlating the geophysical data with parameters of interest such as fracture continuity, orientation, and fracture density. DOE

N83-18467# Gilbert/Commonwealth, Reading, Pa

PROGRAM PLANNING FOR FUTURE IMPROVEMENT IN MANAGING ORNL'S RADIOACTIVE WASTES

Jan 1982 361 p refs

(Contract W-7405-ENG-26)

(DE82-007721, ORNL/SUB-79/13837/7) Avail NTIS HC A16/MF A01

This is intended to serve as a reference document and guide in developing the long-term improvements section of ORNL's radioactive waste management plan. The report reviews ORNL's operations and future program needs in terms of currently applicable DOE regulations and also in terms of regulations and accepted practices of the commercial sector of the nuclear power industry so that the impact of potential future adoption of these regulations and standards on ORNL's operations can be fully evaluated. The principal conclusion reached after reviewing ORNL's waste management operations is that these operations are currently being conducted in a manner that does not endanger the health or safety of workers or the general public and that does not have an adverse effect on the environment. Although nineteen specific problem areas have been identified all of these problems can be attributed to one of the following: (1) the legacy of past practices, (2) gradual deterioration of systems which have reached (or are near to reaching) the end of their reasonable design lives, and (3) potential changes in regulations applicable to ORNL. DOE

N83-18555# Department of Energy, Washington, D C Office of Nuclear Power Systems

PROGRAM MANAGEMENT PLAN FOR THE CONDUCT OF A RESEARCH, DEVELOPMENT AND DEMONSTRATION PROGRAM FOR IMPROVING THE SAFETY OF NUCLEAR POWERPLANTS

Dec 1981 15 p

(DE82-008776, DOE/NE-0032) Avail NTIS HC A02/MF A01

Public Law 96-567, Nuclear Safety Research Development, and Demonstration Act of 1980, (the Act) which provides for an accelerated and coordinated program of light water reactor safety research, development, and demonstration is discussed. The Department of Energy (DOE) initiated its response to Section 4 of the Act by conducting individual information gathering meetings with Nuclear Regulatory Commission (NRC) and a wide cross section of the nuclear industry. Needs of type of activities were recommended. It is concluded that the Department's ongoing Light Water Reactor (LWR) safety program is responsive to the Act. The Department's ongoing program includes tasks in the areas of regulatory assessment, risk assessment, fission product source term, and emergency preparedness as well as providing technical

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

assistance to the Institute of Nuclear Power Operations (INPO) to improve training of nuclear power personnel DOE

N83-18592# Comsis Corp., Wheaton, Md
OWNERSHIP AND USAGE OF SMALL PASSENGER VEHICLES: FINDINGS FROM THE 1977 NATIONAL PERSONAL TRANSPORTATION STUDY

Dec. 1981 227 p

(Contract DE-AC01-80CS-50134)

(DE82-011045, DOE/CS-50134/T1) Avail NTIS HC A11/MF A01

This report examines current patterns in the ownership and usage of small vehicles by private households. The analysis was conducted to shed additional light on the market potential for smaller, energy efficient vehicles, in particular, electric cars. The 1977 Nationwide Personal Transportation Survey (NPTS) was used to obtain information on the socio-demographic characteristics and the travel and vehicle ownership behavior of US households based on a national probability sample. The issues posed to direct the investigation of small vehicle ownership and use behavior include: the ownership of small vehicles; the proportion of the private vehicle population accounted for by small vehicles, how small and large vehicles compare in terms of physical characteristics and performance and terms of usage, and how small/large vehicle ownership and usage differences are explained by household differences or physical differences in the vehicles themselves DOE

N83-18647*# Princeton Univ., N. J.
GENERAL AVIATION AIRPLANE FUEL ECONOMY SYSTEM MODEL

R. PARKINSON, L. M. SWEET, and H. CURTIS /in NASA Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 p 131-142 Mar 1981 Previously announced as N81-22011

Avail NTIS HC A07/MF A01 CSCL 01C

The aerodynamic characteristics which affect the fuel consumption of general aviation aircraft are outlined. All data are presented in the form of graphs R.C.T

N83-18963# California Univ., Berkeley Lawrence Berkeley Lab Energy and Environment Div
ENERGY AND LIFE-CYCLE COST ANALYSIS OF A SIX-STORY OFFICE BUILDING

I. TURIEL Oct 1981 15 p refs Presented at the Intern. Conf. on Energy Use Management-3, West Berlin, 26-30 Oct. 1981

(Contract W-7405-ENG-48)

(DE82-004840, LBL-12837, CONF-811006-10) Avail NTIS HC A02/MF A01

An energy analysis computer program, DOE-2, was used to compute annual energy use for a typical office building as originally designed and with several energy conserving design modifications. The largest energy use reductions were obtained with the incorporation of daylighting techniques, the use of double pane windows, night temperature setback, and the reduction of artificial lighting levels. A life-cycle cost model was developed to assess the cost-effectiveness of the design modifications discussed. The model incorporates such features as inclusion of taxes, depreciation, and financing of conservation investments. The energy conserving strategies are ranked according to economic criteria such as net present benefit, discounted payback period, and benefit to cost ratio DOE

N83-18978# RAND Corp., Santa Monica, Calif
FUTURE ANALYSIS, FORECASTING AND PLANNING FOR TELECOMMUNICATIONS, ENERGY AND PUBLIC UTILITIES

B. M. MITCHELL Aug 1982 8 p Presented at the 4th Intern. Conf., Paris, 30 June 1982

(RAND-P-6796) Avail: NTIS HC A02/MF A01

Within their national borders, public utilities and public enterprises operate in a largely homogeneous environment. To a considerable extent, the same market conditions, national economic

factors, and technology are found throughout any one country. It is in comparing the public enterprises of different countries that significant differences among the basic environments of these organizations emerge--differences in the economic structure and organization of the industry, in the role of national government, and even in the analytic techniques used by forecasters. Author

N83-19213# Indian Inst. of Tech., New Delhi.
TWO LEVEL MULTI-OBJECTIVE RECONNAISSANCE SYSTEM STUDY OF A LARGE WATER RESOURCE SYSTEM Ph.D. Thesis

U. C. CHAUBE 1982 295 p refs

(PB82-239716) Avail: NTIS HC A13/MF A01 CSCL 02C

Reconnaissance study of a large water resource system involves analysis of subsystem characteristics and subsystem interlinkages in terms of total system development objectives. Linear optimization models are developed to represent, aggregate temporal and spatial characteristics of the system; predominant policies, namely irrigation and energy development, and the related issues and technological options, in physical terms. A large system is viewed in terms of several constituent subsystems in which level-1 study relates to irrigation and energy development. These level-1 and level-2 studies were carried out in the context of developmental planning of Ganga basin. The basin is characterized by predominant agriculture based economy and temporal and regional heterogeneity in the resource availability and demand pattern. The relative impact of various issues on the irrigation and energy policies in planning subregions and trade-offs which would form the basis of further creative development and detailed systems analysis is brought out. Author (GRA)

N83-19227*# Duke Univ., Durham, N. C. Center for Solid-State Power Conditioning and Control
RESEARCH ON SPACECRAFT ELECTRICAL POWER CONVERSION Final Report

T. G. WILSON 31 Jan. 1983 21 p refs

(Contract NGL-34-001-001)

(NASA-CR-169974, NAS 1 26 169974) Avail NTIS HC A02/MF A01 CSCL 10A

The history of spacecraft electrical power conversion in literature, research and practice is reviewed. It is noted that the design techniques, analyses and understanding which were developed make today's contribution to power computers and communication installations. New applications which require more power, improved dynamic response, greater reliability, and lower cost are outlined. The switching mode approach in electronic power conditioning is discussed. Technical aspects of the research are summarized. E.A.K.

N83-19289# Pacific Northwest Lab., Richland, Wash.
OVERVIEW OF EXISTING RESIDENTIAL ENERGY-EFFICIENCY RATING SYSTEMS AND MEASURING TOOLS

P. L. HENDRICKSON, B. A. GARRETT-PRICE, and T. A. WILLIAMS Oct 1982 178 p refs

(Contract DE-AC06-76RL-01830)

(DE83-003148, PNL-4359) Avail: NTIS HC A09/MF A01

Three categories of rating systems/tools were identified: prescriptive, calculational, and performance. Prescriptive systems include rating systems that assign points to various conservation features. The calculational category includes computational tools that are used to estimate energy consumption. Performance systems refer to residential energy efficiency ratings that are based on past fuel consumption of a home. There are few of these systems. The extent of field validation/verification of individual systems and tools is discussed. A bibliography of literature relevant to the use and implementation of a home energy rating system is also included. DOE

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-19290# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment
SUPERINSULATED HOMES IN NORTH AMERICA: A REVIEW AND UPDATE

D A HAGAN 1982 11 p refs Presented at the ASME Solar Energy Div. 4th Ann Tech Conf., Albuquerque, N. Mex., 26-30 Apr 1982

(Contract DE-AC02-76CH-00016)

(DE82-011565; BNL-30809, CONF-820410-8) Avail: NTIS HC A02/MF A01

A review of the development of the so-called superinsulated home technology is presented. Major contributors to the conceptualization, test, and implementation phases are categorized. An updated list of information sources is then presented. Two publication lists are included, an introductory reading list for the person seeking a general but analytic introduction to the field and a reference list for those with more specific interests. A list of manufacturers of air-to-air heat exchangers for residences is also included

DOE

N83-19291# Faucett (Jack) Associates, Inc., Chevy Chase, Md.
STUDY OF DOMESTIC SOCIAL AND ECONOMIC IMPACTS OF OCEAN THERMAL ENERGY CONVERSION (OTEC) COMMERCIAL DEVELOPMENT. VOLUME 1: ECONOMIC IMPACTS

22 Dec 1981 100 p refs 2 Vol

(Contract DE-AC01-80CS-80002)

(DE83-001111; DOE/CS-80002/T1-VOL-1) Avail: NTIS HC A05/MF A01

The economic impacts associated with OTEC development are identified and they are quantified by national, regional, and industry levels. The effects on the United States' economy of the domestic development and utilization of 25 and 50 400 MWe OTEC power plants by the year 2000 are focused on. Economic impact analysis was emphasized. A likely future OTEC scenario was developed on the basis of technological, siting, and materials requirements parameters. The industries affected by OTEC development are identified and an economic profile was constructed for each of these industries. The profiles established an industrial baseline from which the direct, indirect, and induced economic impacts of OTEC implementation was estimated. Each stage of this analysis is summarized, and the economic impacts are addressed

DOE

N83-19292# Faucett (Jack) Associates, Inc., Chevy Chase, Md.
STUDY OF DOMESTIC SOCIAL AND ECONOMIC IMPACTS OF OCEAN THERMAL ENERGY CONVERSION (OTEC) COMMERCIAL DEVELOPMENT. VOLUME 2: INDUSTRY PROFILES

22 Dec 1981 163 p 2 Vol.

(Contract DE-AC01-80CS-80002)

(DE83-001112, DOE/CS-80002/T1-VOL-2) Avail: NTIS HC A08/MF A01

Economic profiles of the industries most affected by the construction, deployment, and operation of ocean thermal energy conversion (OTEC) powerplants are presented. Six industries which contribute materials and/or components to the construction of OTEC plants are identified. These industries are steel industry, concrete industry, titanium metal industry, fabricated structural metals industry, fiber glass reinforced plastics industry, and electrical transmission cable industry. The economic profiles for these industries detail the industry's history, its financial and economic characteristics, its technological and production traits, resource constraints that might impede its operation, and its relation to OTEC. Some of the historical data described include output, value of shipments, number of firms, prices, employment, imports and exports, and supply demand forecasts. Profiles are included on the sectors of the economy which will actually construct, deploy, and supply the OTEC platforms

DOE

N83-19294# Thermo Electron Corp., Waltham, Mass
PRELIMINARY ANALYSIS OF THE STATE OF THE ART OF ROBOTICS AND PRECISION ENGINEERING AND EVALUATION OF POTENTIAL FOR IMPROVED ENERGY UTILIZATION IN THE PULP, PAPER, AND RELATED ENERGY-CONSUMING PROCESSES Final Report

Jan. 1982 64 p refs

(Contract DE-AC02-81CS-90024)

(DE83-001016, DOE/CS-90024/1; TE660-406-82) Avail: NTIS HC A04/MF A01

The state of the art of two technologies, robotics and precision engineering, was analyzed and their potential for improved energy utilization in the pulp, paper, and related energy consuming processes was evaluated. A large part of that support is associated with visualization and tactile sensors which facilitate assembly, placement, inspection, and tracking. The critical path in the development of robotic systems lies in the generation of reliable sensor signals. A program which attempts to develop a spectrum of sensor capabilities was established. Such sensors are applicable to robotic system automatic process control in a variety of energy intensive industries. Precision engineering is defined as the generation or manufacture of components wherein geometry, dimension, and surface finish are controlled to within several hundred Angstroms in single point turning operations

DOE

N83-19304# Minnesota Univ., Minneapolis Dept. of Civil and Mining Engineering

DEVELOPMENT AND IMPLEMENTATION OF DYNAMIC METHODOLOGIES FOR EVALUATING ENERGY CONSERVATION STRATEGIES Final Report, Aug. 1980 - Sep. 1981

Y. J. STEPHANEDES, P. G. MICHALOPOULOS, D. A. GABRIEL, H. HANNA, and R. PLUM Apr 1982 181 p refs 2 Vol.

(Contract DOT-UMTA-MN-11-0004)

(PB82-240763; UMTA-MN-11-0004-82-2) Avail: NTIS HC A09/MF A01 CSCL 13F

The modified TRANSIT1 simulation model is developed and implemented to test a wide range of transportation-related energy conservation policies and evaluate their impacts across time. The dynamic structure is based on a set of nonlinear differential equations describing the demand-supply-resource-energy interactions in a transportation system. Time delays associated with fluctuations in travel demand and management responsiveness to those fluctuations are explicitly included. Congestion effects on highway travel times are incorporated by connecting TRANSIT1 to the freeway FREQ6 programs

GRA

N83-19305# Minnesota Univ., Minneapolis Dept. of Civil and Mining Engineering

DEVELOPMENT AND IMPLEMENTATION OF DYNAMIC METHODOLOGIES FOR EVALUATING ENERGY CONSERVATION STRATEGIES. EXECUTIVE SUMMARY Final Report, Aug. 1980 - Sep. 1981

Y. J. STEPHANEDES, P. G. MICHALOPOULOS, D. A. GABRIEL, H. HANNA, and R. PLUM Apr 1982 11 p 2 Vol.

(Contract DOT-UMTA-MN-11-0004)

(PB82-240771; UMTA-MN-11-0004-82-1) Avail: NTIS HC A02/MF A01 CSCL 13F

The development of a dynamic structure modeling the transportation/energy interactions in urban areas is discussed. The modified TRANSIT1 simulation model is developed and implemented to test a wide range of transportation-related energy conservation policies and evaluate their impacts across time. The two major objectives were to determine ways in which dynamic energy conservation policies act to conserve energy and influence resident mobility and transportation system economic performance both in the short-term and long-term and; develop dynamic methodologies to evaluate these energy conservation policies in terms of their impacts through time. A four-step research plan was formulated to address these objectives and this plan is discussed

GRA

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-19306# National Bureau of Standards, Washington, D C
Building Equipment Div
STRATEGIES FOR ENERGY CONSERVATION IN SMALL OFFICE BUILDINGS

W H. PARKEN, J Y KAO, and G E KELLY Jul 1982 56 p
refs

(Contract EA-77-A-01-6010)

(PB82-245820; NBSIR-82-2489) Avail NTIS HC A04/MF A01
CSCL 10A

A comparative analysis is made of the thermal performance of a small office building using various heating ventilation and air conditioning (HVAC) systems and commonly employed strategies. The comparisons are made for seven geographical locations representing wide climatic variations within the continental United States. Results were obtained for fan, space heating hot water, and chilled water energy consumption through hour-by-hour simulations using the BLAST computer program. A small office building model was used in the simulations along with several HVAC systems, a constant volume reheat unit (serving the entire building), dual constant volume reheat units (serving separate zones of the building), and a variable air volume reheat unit. The strategies investigated included supply air temperature reset (constant, zone-controlled, and outdoor air-controlled), economy cycles (temperature and enthalpy), continuous conditioning versus conditioning only during occupied hours, changes in reheat set point temperature, and changes in minimum variable air volume ratio
Author (GRA)

N83-19307# National Swedish Inst. for Building Research, Stockholm

SWEDISH NATIONAL AND LOCAL GOVERNMENT PROGRAMS FOR CONSERVATION OF ENERGY IN BUILDINGS

T. KLINGBERG, J. BROECHNER, L. ENGEBECK, C. ERICSSON, and O. HIRN 1982 183 p refs

(PB82-246752, ISBN-91-540-9134-9, M/B-M82:14,

ISSN-0347-4348) Avail. NTIS HC A09/MF A01 CSCL 10A

A broad scope of subjects within the area of promotion of energy conservation is treated. The Swedish institutional system for building, housing and energy is briefly described. The national energy conservation goal is presented and discussed. Different government measures to promote energy conservation, such as the building codes and the loans and grants system, are described and some questions are raised. Some essays deal with informational programs and training of energy advisors. The conflict between energy aspects and architectural qualities is discussed. Finally, a case-study of energy conservation in three Swedish municipalities is summarized and the activities - and non-activities - of the local authorities are analyzed
Author (GRA)

N83-19313# REAP Associates, Inc., Washington, D.C.
FEDERAL ENERGY CONSERVATION PROGRAMS. PERSPECTIVES FROM THE PUBLIC AND PRIVATE SECTORS. VOLUME 2: PUBLIC HEARING, JULY 14 AND 15, 1981, WASHINGTON, D.C.

May 1982 470 p 3 Vol

(Contract EPA-68-02-3669)

(PB82-238544, EPA-000/9-82-0098) Avail. NTIS HC A20/MF A01 CSCL 10A

The federal governments' energy conservation programs were examined. Testimony regarding issues discussed at the hearing include: energy policy, benefits of energy conservation, state and local governments and private sector activities, successes and failures of federal programs, barriers to conservation and a continuing federal role.
GRA

N83-19314# Illinois Univ., Urbana-Champaign Dept of Mechanical and Industrial Engineering
RESIDENTIAL AND COMMERCIAL COGENERATION SYSTEMS ASSESSMENT Final Report, Mar. 1981 - Feb. 1982

C W BULLARD and S J PIEN Chicago, Ill. Gas Research Inst Mar. 1982 110 p refs

(Contract GRI-5081-346-0455)

(PB82-240037, GRI-81/0060) Avail NTIS HC A06/MF A01
CSCL 10B

It is possible for cogenerators to be producers of peak and intermediate load electricity if they are designed with enough storage capacity to track daily thermal loads in buildings. The thermal storage would act to buffer any mismatch between thermal loads and electric utility peak periods. Over a wide range of technical performance characteristics and thermal load profiles, it appears that cogeneration systems having installed costs in the \$500 to \$1500 kW range will be economically feasible if they can be sized to take advantage of peak and intermediate electricity values in the range of 6 to 9 cents/kWh. These results were obtained assuming a fuel cost of 2 cents/kWh t (\$6/MMBtu). The optimal size of such systems is often larger than the building's peak thermal load.
GRA

N83-19328# Los Alamos Scientific Lab., N Mex

POTENTIAL BIOLOGICAL HAZARDS OF NICKEL ARSENIDES ASSOCIATED WITH RETORTING OF OIL SHALE: TOXIC EFFECTS OF PARTICULATE Ni5As2

L R GURLEY, R. A TOBEY, J G VALDEZ, M S HALLECT, and S S BARHAM (Mayo Clinic/Foundation) Nov 1981 26 p
refs

(Contract W-7405-ENG-36)

(DE82-010978, LA-8995-MS) Avail NTIS HC A03/MF A01

Oil shale retort operating conditions, oil shale elemental composition, nickel and arsenic physicochemical properties, and oil shale matrix structure led to the suggestion that nickel arsenides may be formed during the oil shale retorting process. Crystal structure similarities between nickel subarsenide and the potent carcinogens nickel subsulfide and nickel subselenimide have caused concern that nickel arsenides may have adverse effects on biological systems. Fugitive nickel arsenides from an oil shale retort were studied to determine if they pose a threat to personnel in the workplace or to other living organisms in the environment. The toxicity of nickel arsenides was investigated. Five stable nickel arsenides Ni5As2, Ni2As, Ni11As8, NiAs, and NiAs2 and nickel arsenic sulfide (NiAsS) are considered possible species for consideration. Some effects of particulate Ni5As2 on cultured mammalian cells are described
DOE

N83-19329# Oak Ridge National Lab., Tenn. Environmental Sciences Div.

ANALYSIS OF ENVIRONMENTAL ISSUES RELATED TO SMALL-SCALE HYDROELECTRIC DEVELOPMENT. 6: DISSOLVED OXYGEN CONCENTRATIONS BELOW OPERATING DAMS

G. F CADA, K D. KUMAR, J A SOLOMON, and S G HILDEBRAND Jan 1982 99 p refs

(Contract W-7405-ENG-26)

(DE82-007127, ORNL/TM-7887-6; ESD-PUBL-1828-6) Avail NTIS HC A05/MF A01

Results are presented of an effort aimed at determining whether or not water quality degradation, as exemplified by dissolved oxygen concentrations, is a potentially significant issue affecting small-scale hydropower development in the US. The approach was to pair operating hydroelectric sites of all sizes with dissolved oxygen measurements from nearby downstream US Geological Survey water quality stations (acquired from the WATSTORE data base). The USGS data were used to calculate probabilities of non-compliance (PNCs), i.e., the probabilities that dissolved oxygen concentrations in the discharge waters of operating hydroelectric dams will drop below 5 mg/l. PNCs were estimated for each site, season (summer vs remaining months), and capacity category. Because of the low numbers of usable sites in many states, much

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

of the subsequent analysis was conducted on a regional basis.

DOE

N83-19331# Argonne National Lab., Ill. Div. of Environmental Impact Studies.

HEALTH AND ENVIRONMENTAL EFFECTS DOCUMENT FOR BATTERIES, 1981. THE ZINC/HALOGEN BATTERIES

Nov 1981 191 p refs

(Contract W-31-109-ENG-38)

(DE82-006987; ANL/ES-119) Avail: NTIS HC A09/MF A01

This document is an assessment of the health and ecological effects of the zinc/halogen batteries (zinc/chloride and zinc/bromine) as related to electric and hybrid vehicles and load-leveling applications. Emissions have been estimated for the complete cycle. Emissions have been estimated for the production capability per kWh of battery and for per module of battery. These values are amenable to scaling up as warranted. Emissions of interest regarding ecological effects are from zinc, titanium, and graphite industries. An analysis of Pb emissions, from the zinc industry, their ecological effects, and movements through the food chains has been attempted. Health effects as a result of increased levels of Pb, Cd, SO₂ and particulates, and vinyl chloride have been assessed using mathematical models for dose-response relationship. Risks of injury to those employed in battery-related industries are also assessed. Potential health effects of chlorine exposure from accidents involving electric vehicles powered by zinc chloride batteries are evaluated.

DOE

N83-19333# California Univ., Livermore Lawrence Livermore Lab.

GEOTOXIC MATERIALS IN THE SURFACE ENVIRONMENT

J J KORANDA, J J COHEN (Science Applications, Inc.), C. F. SMITH (Science Applications, Inc.), and F. J. CIMINESI (California State Univ.) 7 Dec. 1981 65 p refs

(Contract W-7405-ENG-48)

(DE82-005855, UCRL-53215) Avail: NTIS HC A04/MF A01

The toxicology and natural occurrence of several recognized geotoxic elements including arsenic, cadmium, chromium, nickel, lead, selenium, uranium, and vanadium is reviewed. The behavior of these elements in the environment and in biological systems is examined. The properties of these eight toxic elements are summarized and presented in a toxicity matrix. The toxicity matrix identifies each of the elements in terms of average crustal abundance, average soil concentration, drinking water standards, irrigation water standards, daily human intake, aquatic toxicity, phytotoxicity, mammalian toxicity, human toxicity, and bioaccumulation factors for fish. Fish are the major aquatic environment contribution to the human diet and bioaccumulation in aquatic ecosystems is an important factor in the cycling of elements in aquatic ecosystems. The ranking from highest to lowest toxicity with respect to the toxicity parameters being discussed is as follows: arsenic, cadmium, lead, selenium, chromium, vanadium, nickel, and uranium.

DOE

N83-19334# Bechtel National, Inc., San Francisco, Calif
GENERIC ENVIRONMENTAL AND SAFETY ASSESSMENT OF 5 BATTERY ENERGY-STORAGE SYSTEMS Final Report

A W METWALLY Dec 1981 196 p refs Sponsored by Electric Power Research Inst

(Contract EPRI PROJ. 1317-1)

(DE82-902212, EPRI-EA-2157) Avail: NTIS HC A09/MF A01

Battery energy storage systems store off peak energy from electric power plants for use at time of peak energy demand. This study provides generic environmental assessments of five battery energy storage systems: lead acid, zinc chloride, zinc bromine, sodium sulfur, and lithium metal sulfide. No significant environmental effects are associated with the normal operation of the five battery energy storage systems. Potential effects, such as accidents or disposal of hazardous wastes, affect the acceptance of these technologies. The availability of raw materials - such as lead, calcium, aluminum, and lithium - may affect the large scale manufacturing of battery energy storage systems.

Existing manufacturing capacity and ability to expand may also affect the potential for their increased use

DOE

N83-19340# Industrial Environmental Research Lab., Research Triangle Park, N C

STATE-OF-THE-ART COMBUSTION MODIFICATION NOX CONTROL FOR STATIONARY COMBUSTION EQUIPMENT

R E HALL and J S BOWEN, JR 1982 19 p refs Presented at the US-Dutch Intern Symp on NOx, Maastricht, Netherlands, 24-28 May 1982

(PB82-240201, IERL-RTP-P-519, EPA-600/D-82-326) Avail:

NTIS HC A02/MF A01 CSCL 13B

State of the art combustion modification NOx control technology for boilers and industrial process combustion equipment are discussed. These combustion modification techniques, when properly applied, offer the potential for cost effective NOx control for the major fossil fuel fired stationary combustion sources in the near term.

GRA

N83-19356# Radian Corp., Austin, Tex

EVALUATION OF THE MAINTENANCE EFFECT ON FUGITIVE EMISSIONS FROM REFINERIES IN THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT Final Report, Dec. 1980 - Sep. 1981

R L HONERKAMP, M L SCHWENDEMAN, and L P PROVOST Jun 1982 233 p

(Contract EPA-68-02-3171)

(PB82-239260, RAD-82-203-001-30-17; EPA-600/7-82-049;

IERL-RTP-1289) Avail: NTIS HC A11/MF A01 CSCL 13B

Results of a data collection investigation of the effectiveness of rules to control volatile organic compound fugitive emissions from California's South Coast Air Quality Management District (SCAQMD) are given. A leak detection survey (hydrocarbon detector screening) at two refineries in the SCAQMD and refinery records from previous inspections were reviewed. Other data was collected to evaluate the effect of screening at various distances from the source for pump and compressor seals, and to evaluate seal lifetimes or replacement policies.

GRA

N83-19420# Health Effects Research Lab., Research Triangle Park, N C

SHORT-TERM BIOASSAYS IN THE ANALYSIS OF COMPLEX ENVIRONMENTAL MIXTURES 2

M D WATERS, S S SANDHU, J L HUISINGH, L CLAXTON, and S NESNOW Mar. 1982 499 p refs Proc. of the US EPA's 2nd Symp., Williamsburg, Va. 4-7 Mar. 1980

(Contract W-7405-ENG-48; EPA-79-D-X0826)

(PB82-233172; EPA-600/9-82-004) Avail: NTIS HC A21/MF

A01 CSCL 06T

A number of topics related to bioassays are discussed. Ambient air, water and soil analysis is discussed. The sources of environment pollution: mobile source emissions, industrial emissions and effluents are discussed. Risk assessment and health hazards are discussed.

Author (GRA)

N83-19462# Environmental Protection Agency, Research Triangle Park, N C Health Effects Research Lab

DIESEL EMISSIONS SYMPOSIUM PROCEEDINGS

Jul 1982 647 p refs Symp held in Raleigh, N.C., Oct. 1981

(PB82-244013, EPA-600/9-72-014) Avail: NTIS HC A99/MF

A01 CSCL 06T

The following subject areas relating to diesel emissions are discussed: diesel emissions characterization and control technology; chemical and bioassay characterization; pulmonary function, toxicology, and biochemistry; mutagenesis; carcinogenesis; exposure, and risk assessment

Author (GRA)

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-19634# Institution of Engineers, Calcutta (India).
ENGINEERING THE FUTURE FOR THE BENEFIT OF MANKIND, VOLUME 2

Jun. 1981 171 p refs Proc of the Natl Seminar, Calcutta, 17-19 Feb. 1980 Previously announced as N83-70307 (PB82-225491) Avail NTIS HC A08/MF A01 CSCL 05K

This seminar was organized with a view to visualize and enlist the task which the engineering community should undertake in meeting the technological challenges brought about by the unprecedented rapid developments in science and technology all over the world Distinguished speakers were invited to highlight the intricate interlinkage between the different facets of the multi-dimensional problems of future development along with a meaningful enriched life for the community as well as the individual. This volume of proceedings is comprised of recommendations, plenary lectures and keynote addresses delivered at the various sessions. The topics covered are. Food for the Millions, Technologies for Total Water Management, Rural and Urban Housing, New Horizons of Man-made and Natural Fibers; Challenges of Energy Crisis, New Approaches to Habitat vis-a-vis Environment, Transport in Future; Engineering for Better Health; and The Need of Increased International Cooperation GRA

N83-19651*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
IMPLEMENTATION OF R & QA PRACTICES IN RESEARCH AND DEVELOPMENT PROGRAMS

H. BANKAITIS 14 Mar 1983 18 p refs Proposed for presentation at 37th Ann. Quality Congr, Boston, 24-26 May, 1983, sponsored by Am Soc for Quality Control (Contract DE-A101-77CS-51040) (NASA-TM-82997, DOE/NASA/51040-42, E-1430, NAS 1 15 82997) Avail. NTIS HC A02/MF A01 CSCL 05A

DOE has established a number of broad programs aimed at reducing fuel consumption Several programs address the R&D of ground transportation propulsion alternatives to the conventional spark-ignition engine NASA Lewis is responsible for managing the effort between the Government and industry teams involving American and foreign companies. Thus, existing NASA SR&QA procedure were modified/adapted to these R&D programs and implemented to assure that the test hardware design intent was met, the hardware was not hazardous to personnel, it would demonstrate reliable operation, and it would help establish the future R&D quality assurance and maintainability requirements This successful low-cost approach might be applicable to other similar projects Author

N83-19780*# Jet Propulsion Lab, California Inst of Tech., Pasadena Systems Engineering Section
AN OVERVIEW OF THE GOLDSTONE ENERGY SYSTEMS STUDY

L S. ROSENBERG *In its* The Telecommun. and Data Acquisition Rept p 135-141 15 Feb 1983 Avail: NTIS HC A11/MF A01 CSCL 10B

A systems planning methodology was developed for analyzing and synthesizing Deep Space Network (DSN) energy systems The resultant product, the Deep Space Network Planning and Analysis Methodology supports DSN energy planning evaluations It addresses a broad spectrum of tradeoff and dispatching scenarios It evaluates a variety of energy generation configurations and also includes a capability to evaluate conservation measures S.L.

N83-19923# Committee on Science and Technology (U. S. House)

THE SOCIOECONOMIC IMPACTS OF SYNTHETIC FUELS
Washington GPO 1982 331 p refs Hearing before the Subcomm on Energy Develop and Appl of the Comm. on Sci. and Technol, 97th Congr, 2d Sess., 28 Apr 1982 (GPO-98-702) Avail Subcommittee on Energy Development and Applications

Federal assistance is needed for the development of synthetic fuels in order to convert natural resources to more usable energy

forms Various aspects of the synthetic fuels industry development are presented including oil shale extraction and proposals for five other projects. S.L.

N83-19950# AIA Research Corp., Washington, D C.
NEW DESIGN CONCEPTS FOR ENERGY-CONSERVING BUILDINGS. RESULTS OF A NATIONAL COMPETITION AMONG STUDENTS IN SCHOOLS OF ARCHITECTURE

1982 120 p
(Contract DE-AC01-76CS-18458)
(DE82-013319, DOE/CS-28458/T1) Avail NTIS (US Sales Only) HC A06/MF A01, DOE Depository Libraries

The National Student Competition in Energy Conscious Design held among professional schools of architecture in 1976 is documented Fifty-five schools participated, submitting 115 entries, twelve were chosen as finalists. Details are presented on the twelve winning designs and excerpts from the remaining 103 entries are published. DOE

N83-19956# General Electric Co., Philadelphia, Pa Energy Systems and Technology Div.

ANALYSIS AND DESIGN OF RESIDENTIAL LOAD CENTERS. VOLUME 2: APPENDICES Final Report

E. M. MEHALICK, R. LAMBERS, G. OBRIEN, G. F. TULLY, and J. PARKER Mar 1982 88 p refs
(Contract DE-AC04-76DP-00789)
(DE82-014253, SAND-80-7017-VOL-2) Avail NTIS HC A05/MF A01

These three appendices present information on residential load center classification information Emphasis is given to: residential development trends and residential housing classifications; detached house site layout alternatives; and legal and institutional issues, including condominium ownership, commercial ownership of photovoltaic systems in mobile homes, and utility ownership of photovoltaic systems DOE

N83-19957# Department of Energy, Washington, D C Office of Consumption Data System.

TECHNICAL DOCUMENTATION FOR THE NONRESIDENTIAL-BUILDINGS ENERGY-CONSUMPTION SURVEY, 1979 - 1980, BUILDING CHARACTERISTICS, ENERGY END USE AND FUEL OIL TANK DATA, PUBLIC USE DATA TAPES: USERS' GUIDE

Feb. 1982 224 p refs
(DE82-012523, DOE/EIA-0327) Avail. NTIS HC A10/MF A01

Basic information and technical specifications necessary for using machine readable magnetic tapes containing the building characteristics, energy end use and fuel oil tank data Nonresidential Buildings Energy Consumption Survey (NBECS) are provided Included in this document are a brief overview of the NBECS, technical specifications for reading the tapes and descriptions of the contents of each of the files contained on the tape The remaining sections are devoted to technical topics of special interest to users of the data Appended to this document are copies of the questionnaire used in the survey, a listing of the contents of the SPSS labels file, COBOL file description and TPL codebook. DOE

N83-20002# Committee on Science and Technology (U. S. House)

US ELECTRIC POWER SYSTEM RELIABILITY

Washington GPO 1982 386 p refs Hearings before the Subcomm. on Energy Develop and Appl and the Subcomm. on Energy Res and Prod of the Comm on Sci and Technol., 97th Congr., 2d Sess, 8, 10 Jun 1982 (GPO-99-628) Avail: Subcommittee on Energy Development and Applications

Electric energy supply, transmission and distribution systems are investigated in order to determine priorities for legislation The status and the outlook for electric power reliability are discussed. S.L.

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-20151# Committee on Science and Technology (U. S. House)

DIESEL TECHNOLOGY

Washington GPO 1983 193 p refs Hearing before the Subcomm on Invest and Oversight of the Comm on Sci and Technol, 97th Congr., 2d Sess, 6 May 1982 (GPO-99-748) Avail. Subcommittee on Investigations and Oversight

The relationship between diesel emissions and health effects are examined. An accurate prediction of diesel utilization on the highways is needed in order to evaluate their impact and design policies concerning them. The issues involved are discussed

S. L.

N83-20334# New York Univ., New York Dept. of Economics
WORLD OIL MODEL DEVELOPMENT Progress Report

D. GATELY 20 Mar 1982 38 p

(Contract DE-AC02-81PE-70326)

(DE82-013979; DOE/PE-70326-2, PR-2) Avail. NTIS HC

A03/MF A01

A revised and updated model of the world oil market is described. The variables and equations in the model are listed. Illustrative projections are presented. The model's historical results are compared with actual historical data for 1973 to 1980. DOE

N83-20336# Stanford Univ., Calif. Dept. of Operations Research

MODELING WATER SUPPLY FOR THE ENERGY SECTOR Final Report

N. BURAS Feb 1982 199 p refs Sponsored by DOE and EPRI

Avail. NTIS HC A09/MF A01

The construction of the WATER-EPM (W-EPM) model which is the energy policy Model (EPM) enlarged to include quantitative descriptions of water availabilities is summarized. To maintain the original structure of EPM, water supply functions are estimated on the basis of information available for the investment required to build storage facilities which can yield the next increment of flow available. A second important feature of the linkage of water and energy submodels in W-EPM is the estimation of a water transportation matrix. The W-EPM includes projections of nonenergy water uses, as a surrogate for water demand functions. Computer test with W-EPM indicates that in the Lower Colorado, Upper Colorado, Great Basin, and Platte-Lower Missouri regions shortages of water may occur as early as the current decade. California, Rio Grande, Texas-Gulf, and Upper Missouri regions may experience water shortages before the end of this century. Early in the next century, the Great Lakes-Ohio, Upper Mississippi, Pacific Northwest, and Arkansas-Lower-Mississippi regions may develop water shortages. DOE

N83-20363# RAND Corp., Santa Monica, Calif.
AN ENERGY CRISIS MANAGEMENT SIMULATION FOR THE STATE OF CALIFORNIA

M. A. THOMAS Aug 1982 74 p Proc. of the Energy Crisis Management Workshop, Santa Monica, Calif., 27-29 Jan 1982. Sponsored by the California State Energy Resources Conservation and Development Commission.

(RAND/R-2899-CEC, LC-82-15038, ISBN-0-8330-0437-9) Avail. NTIS HC A04/MF A01

The Rand Corporation hosted an energy crisis management workshop on January 27-29, 1982. The workshop was sponsored by the California Energy Commission and was designed to give participants experience in managing an energy emergency. The vehicle for providing this experience was a gaming exercise that simulated an international energy emergency. The structure of the game used in the workshop and the game results are documented. Author

N83-20364# Committee on Science and Technology (U. S. House)

THE ROLE OF BUSINESS INCENTIVES IN THE DEVELOPMENT OF RENEWABLE ENERGY TECHNOLOGIES

Washington GPO 1982 134 p Hearing before the Subcomm on Energy Develop and Appl of the Comm on Sci and Technol, 97th Congr., 2d Sess, 13 Jul 1982

(GPO-99-651) Avail. Subcommittee on Energy Development and Applications

A 15% business energy tax credit for renewable energy systems is examined. Witnesses from photovoltaics, solar thermal, wind, and OTEC industries testified about the importance of the credits to their ability to develop and demonstrate new technologies.

Author

N83-20367# Committee on Science and Technology (U. S. House)

RENEWABLE ENERGY IN THE EIGHTIES: NEEDS FOR FURTHER RESEARCH AND DEVELOPMENT

Washington GPO 1982 619 p refs Hearings before the Subcomm on Energy Develop and Appl of the Comm on Sci and Technol, 97th Congr., 2d Sess, 28 May, 28 Jul 1982

(GPO-99-663) Avail. Subcommittee on Energy Development and Applications

Renewable energy research, development, demonstration, solar energy technology research needs, and solar thermal systems research and development needs are discussed.

Author

N83-20369# Committee on Science and Technology (U. S. House)

US SOLAR AND CONSERVATION TECHNOLOGIES IN INTERNATIONAL MARKETS

Washington GPO 1982 419 p Hearings before the Subcomm on Energy Develop and Appl and the Subcomm on Invest and Oversight of the Comm on Sci and Technol, 97th Congr., 2d Sess, 3, 17, 21 Jun 1982

(GPO-99-627) Avail. Subcommittee on Energy Development and Applications

The effect of cutbacks in Federal RD&D spending on conservation and solar technologies proposed in terms of a possible competitive disadvantage for American manufacturers.

Author

N83-20370# Committee on Science and Technology (U. S. House)

BUILDING ENERGY RESEARCH

Washington GPO 1982 211 p Hearing before the Subcomm on Energy Develop. and Appl of the Comm on Sci and Technol., 97th Congr., 2d Sess, 22 Jul 1982

(GPO-11-221) Avail. Subcommittee on Energy Development and Applications

A building energy research program initiative is considered.

Author

N83-20371# Committee on Science and Technology (U. S. House)

ENERGY-EFFICIENT TECHNOLOGY: ADVANCING US COMPETITIVENESS AND PRODUCTIVITY.

L. CRANE, ed and F. SISSINE, ed Washington GPO 1982 189 p refs Presented to the Comm. on Sci and Technol., 97th Congr., 2d Sess, Feb. 1982. Proc. of a seminar held in Washington D.C., 11 Feb 1982. Prepared by the Library of Congr., Congr. Res. Serv.

(GPO-98-637) Avail. US Capitol, House Document Room

Industrial process efficiency, energy conversion equipment, and policies and program are discussed.

Author

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-20373# Committee on Science and Technology (U. S. House)

AMERICAN TECHNOLOGY TRANSFER AND SOVIET ENERGY PLANNING

Washington GPO 1982 229 p refs Hearings before the Subcomm on Invest and Oversight of the Comm on Sci and Technol, 97th Congr, 1st and 2d Sess 10 Dec 1981 and 9 Feb. 1982

(GPO-97-481) Avail Subcommittee on Investigations and Oversight

Concerning Soviet oil and gas, it is proposed that projection of Soviet production is difficult due to lack of precise information. Gas not oil is considered the most crucial sector of Soviet energy expansion. Author

N83-20378# Ministerio das Minas e Energia, Brasilia (Brazil)
BRAZILIAN ENERGY MODEL

May 1981 91 p In SPANISH

(DE82-902461; NP-2902461) Avail NTIS HC A05/MF A01

A summary of the energy situation in Brazil is presented. Energy consumption rates, reserves of primary energy, and the basic needs and strategies for meeting energy self sufficiency are discussed. Conserving energy, increasing petroleum production, and utilizing other domestic energy products and petroleum by-products are discussed. Specific programs are described for the development and use of alcohol fuels, wood and charcoal, coal, schist, solar and geothermal energy, power from the sea, fresh biomass, special batteries, hydrogen, vegetable oil, and electric energy from water power, nuclear, and coal. Details of the energy model for 1985 are given. Attention is also given to the energy demands and the structure of global energy from 1975 to 1985. DOE

N83-20379# Oak Ridge National Lab, Tenn

DISTRICT HEATING AND MORE-EFFICIENT BUILDINGS

G. D. PINE, M. A. KARNITZ, M. A. BRODERS, and W. R. MIXON 1981 8 p Presented at the Energy in the Man-Built Environ The Next Decade Spec Conf., Vail, Colo, 3 Aug 1981 (Contract W-7405-ENG-26)

(DE81-025437; CONF-810808-10) Avail NTIS HC A02/MF A01

The fuel consumed to supply the thermal demands in buildings can be reduced by improving the thermal integrity of buildings or by relying on more efficient methods of converting the fuel energy into heat. It is shown that one conversion option, district heating with cogeneration, requires about the same amount of capital investment per unit of energy saved as required by single-building conservation measures. District heating also offers additional benefits from substitution of more plentiful fuels for oil and gas and improved local air quality in a community. District heating and building efficiency improvements are not mutually exclusive, however, and this analysis indicates that the life cycle cost is minimized when buildings are improved and a district heating system is built. DOE

N83-20405# Department of Energy, Washington, D. C. Office of Market Analysis

INTERNATIONAL ENERGY INDICATORS

E. ROSOI, JR., ed Jan 1982 31 p

(DE82-012504; DOE/IA-0010/17) Avail NTIS HC A03/MF A01

Data are presented under the following headings: world crude oil production, OPEC crude oil productive capacity; world crude oil and refined product inventory levels, and oil consumption in the OECD countries. The USSR crude oil production and exports; free world and US nuclear electricity generation, US domestic oil supply, US gross imports of crude oil and products; landed cost of Saudi crude, current and 1974 dollars; US coal trade, US natural gas trade; summary of US merchandise trade, and energy/GNP ratio data are also included. DOE

N83-20411# New Zealand Energy Research and Development Committee, Auckland

PRESENT AND POTENTIAL USE OF MICRO-HYDROELECTRIC SCHEMES IN REMOTE LOCATIONS

R. J. BLAKELY and K. F. O'CONNOR Oct. 1981 44 p refs (DE82-904687; NZERDC-68) Avail NTIS (US Sales Only) HC A03/MF A01, DOE Depository Libraries

The prospects for generating electric power from mountain streams in remote areas of New Zealand are discussed. Information is provided on public attitudes toward microscale hydroplants, the equipment available for such plants, and the cost of the power generated. Data on turbines in use at present are tabulated. It is recommended that sites be evaluated on an individual basis and that the development of New Zealand produced hydroequipment and control systems for microscale hydroplants be encouraged. DOE

N83-20412# New Zealand Energy Research and Development Committee, Auckland

SMALL HYDRO-ELECTRIC POTENTIAL: WEST POVERTY BAY REGION

Jul. 1981 67 p refs

(DE82-905090; NZERDC-66) Avail NTIS (US Sales Only) HC A04/MF A01; DOE Depository Libraries

Six schemes in the Bay of Plenty Electric Power Board area and two in the Poverty Bay Electric Power Board area, of which five and one, respectively are below the economic limit of \$2400/kW were identified. Only three appear both economically and environmentally acceptable. The schemes identified are not very attractive on the national scale and could not be justified on local terms. It is recommended that a detailed feasibility study of the Takaputahi/Torere diversion is undertaken prior to a decision making to proceed with the Motu development, or if the proposals are dropped. The present low load and slow growth of the area is such that prior to a small hydroelectric scheme is built, demand for power has to be established. DOE

N83-20419# Department of Energy, Washington, D. C.

ASSESSMENT OF THE BASIC ENERGY SCIENCES PROGRAM. VOLUME 2: APPENDICES

Mar 1982 102 p refs

(DE82-013245; DOE/ER-0123-VOL-2) Avail NTIS HC A06/MF A01

A list of experts reviewing the basic energy sciences (BES) program and their organizations are given. The assessment plan is explained, the program examined the following: quality of science being conducted in the program, quality of performers supported by the basic energy sciences (BES) program, and the impact of the research on mission oriented needs. The intent of the assessment is to provide an indication of general status relative to these questions for the BES divisions. The approach to the assessment is described. The sampling plan which was used as a guide in determining the sample size and selecting the sample to evaluate the research program are discussed. Special analyses were conducted on the dispersion of reviewers' ratings, the ratings of the lower funded projects, and the amount of time the principal investigator devoted to the project. These are presented in the final appendix together with histograms for individual rating variables for each program area. DOE

N83-20420# Brookhaven National Lab, Upton, N. Y.

ENERGY PLANNING FOR DEVELOPMENT: NEEDS AND APPROACHES

V. MUBAYI 1981 14 p refs Presented at 5th Intern Sci Forum on Changes in Energy, Mexico City, Mexico, 9 Nov. 1981 (Contract DE-AC02-76CH-00016)

(DE82-014180; BNL-31208; CONF-811196-1) Avail NTIS HC A02/MF A01

The capability of developing countries to carry out comprehensive national energy planning is examined. The analytical methods or models constructed for analyzing the energy system have to take into account the specific context in which they are built to address issues of interest to development planners. Issues

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

discussed are resource development and technology research, energy equity considerations to all peoples in a nation, the pricing policy, and the balance of payments considerations. The importance of the availability of adequate skilled personnel and training programs to impart the requisite skill necessary to carry out the planning is discussed. Various surveys were conducted to determine the training needs for energy planners in developing countries. DOE

N83-20423# Oak Ridge National Lab., Tenn. Program Planning and Analysis

POTENTIAL BENEFITS OF R AND D DIRECTED TOWARD INCREASING THE COST-EFFECTIVENESS OF ENERGY USE

T. D. ANDERSON 17 Mar 1982 9 p refs

(Contract W-7405-ENG-26)

(DE83-013435, DOE/NBM-2013435) Avail NTIS HC A02/MF A01

The need for energy research programs directed toward increasing the cost effectiveness of energy use is discussed. Benefits reaped by society as a consequence of successful completion of a research activity are economic, environmental, health and safety, and security. Emphasis is placed on the economic benefits from research projects on the demand side (i.e., energy end use sectors). Each end use sector was examined and data on the amount of energy consumed and the estimated cost of that energy are compiled. DOE

N83-20424# Department of Energy, Washington, D. C. Office of Consumption Data System

INTRODUCTION TO THE NONRESIDENTIAL BUILDINGS ENERGY-CONSUMPTION SURVEY: 1979-1980 BUILDING CHARACTERISTICS, ENERGY END USE AND FUEL OIL TANK DATA. PUBLIC USE DATA TAPES, SHOPPERS' GUIDE

Feb 1982 53 p refs

(DE82-012522, DOE/EIA-0326) Avail: NTIS HC A04/MF A01

The nonresidential buildings Energy Consumption Survey (NBECS) was designed to provide information related to energy consumption in nonresidential buildings. A representative sample of all nonresidential buildings in the 48 contiguous states and the District of Columbia was selected using a multistage area probability technique. This document is intended to serve as a general introduction to the building characteristics, energy end use, and fuel oil tank data from the 1979-1980 NBECS. These data are available to the public on machine readable magnetic tape. DOE

N83-20427# Center for Renewable Resources, Washington, D. C.

PUTTING RENEWABLE ENERGY TO WORK IN CITIES Final Report

B. MCPERSON, ed., G. MARA, K. COURIER, ed., and K. FINNERAN 1982 463 p refs

(Contract DE-AC01-79ET-20622)

(DE82-016178, DOE/ET-20622/T1) Avail NTIS HC A20/MF A01

The purpose of the book is to supply city officials with information needed to develop local policies that encourage the use of energy conservation and renewable energy technologies. The basic assumptions are that city energy officials need technical information, that urban energy managers must be conscious of the constraints and opportunities posed by existing conditions and that no urban program can afford to overlook the links between energy and housing, employment, and economic development. Part One contains guidelines to help local energy officials assess their own urban energy contexts. Parts Two and Three indicate how different energy technologies might fit within different city contexts or neighborhoods. DOE

N83-20429# Southern California Gas Co., Los Angeles

METAL HYDRIDE/CHEMICAL HEAT-PUMP DEVELOPMENT PROJECT, PHASE 1 Final Report

T. A. ARGABRIGHT Feb 1982 187 p refs

(Contract DE-AC02-76CH-00016)

(DE83-002463, BNL-51539) Avail NTIS HC A09/MF A01

The metal hydride/chemical heat pump (MHHP) is a chemical heat pump containing two hydrides for the storage and/or recovery of thermal energy. It utilizes the heat of reaction of hydrogen with specific metal alloys. The MHHP design can be tailored to provide heating and/or cooling or temperature upgrading over a wide range of input and ambient temperatures. The system can thus be used with a variety of heat sources including waste heat, solar energy or a fossil fuel. The conceptual design of the MHHP was developed. A national market survey including a study of applications and market sectors was conducted. The technical tasks including conceptual development, thermal and mechanical design, laboratory verification of design and material performance, cost analysis and the detailed design of the Engineering Development Test Unit (EDTU) were performed. As a result of the market study, the temperature upgrade cycle of the MHHP was chosen for development. Operating temperature ranges for the upgrader were selected to be from 70 to 1100 C (160 to 2300 F) for the source heat and 140 to 1900 C (280 to 3750 F) for the product heat. DOE

N83-20431# Oak Ridge National Lab., Tenn. Energy Div

ENERGY-DATA VALIDATION: AN OVERVIEW AND SOME CONCEPTS

A. S. LOEBL and S. CANTOR 1981 18 p refs Presented at the Am Statist Assoc. Meeting, Detroit, 10 Aug. 1981

(Contract W-7405-ENG-26)

(DE82-020901; CONF-810842-7) Avail: NTIS HC A02/MF A01

Energy data validation can be viewed operationally as a three-fold assessment process: (1) a determination of the quality of the data collected, i.e., an assessment of accuracy, (2) an analysis of the relevance and usefulness of the data so as to assess how closely the data collected is meeting the requirements of its users, (3) an assessment of measures that can be taken to enhance the effectiveness of the data system under study. Assessment (1) is akin to the process of critical evaluation of data in the physical sciences. Assessments (2) and (3), the more distinctive features, underlie two important goals of validation. In brief, the analyst validates both the information and the requirements for the information, and as deficiencies in these two aspects are uncovered, the validation analyst formulates and evaluates the means for correcting these deficiencies. This paper focuses upon the use of an error model for systematizing the assessment of accuracy in a data-system validation study. DOE

N83-20433# Stanford Univ., Calif.

WORLD OIL

J. L. SWEENEY Jun 1982 129 p refs Sponsored by Electric Power Research Inst

(Contract EPRI PROJ. 875-1-8)

(DE82-906440, EPRI-EA-2447-SY) Avail NTIS HC A07/MF A01

Results obtained through the application of 10 prominent world oil or world energy models to 12 scenarios are reported. These scenarios were designed to bound the range of likely future world oil market outcomes. Conclusions relate to oil market trends, impacts of policies on oil prices, security of oil supplies, impacts of policies on oil security problems, use of the oil import premium in policymaking, the transition to oil substitutes, and the state of the art of world oil modeling. DOE

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-20435# CSI Resource Systems, Inc., Boston, Mass
BI-STATE SOLID-WASTE-TO-ENERGY PROJECT
Dec. 1982 160 p Prepared in cooperation with Bi-State Development Agency, St Louis
(Contract DE-FG01-79CS-20233)
(DE83-004458, DOE/CS-20233/1) Avail NTIS HC A08/MF A01

The system concept developed will comprise a 600 ton per day waste-fired facility (with supplemental oil or gas fired package boilers) selling steam to the City of St. Louis. The history of activities is presented, and project activities are summarized in 10 major task areas: waste quantity and characteristics, energy and materials market development and negotiations, technical and market evaluation of the steam loop, final site and system selection, environmental impact assessment; economic and financial analysis; structuring of the project; procurement documents preparation and issue; contractor selection and negotiation, and project management. For each task, the activities performed, its status, and conclusions as appropriate are presented. GRA

N83-20438# National Science Foundation, Washington, D C
Div. of Policy Research and Analysis
WORKSHOP ON THE FEDERAL ROLE IN THE COMMERCIALIZATION OF LARGE SCALE WINDMILL TECHNOLOGY (SUMMARY AND PAPERS)
J. I. LERNER and G. MILLER 1982 141 p refs Workshop held at Washington, D C, 25-26 Sep 1980
(PB83-105593, NSF/PRA-82012) Avail NTIS HC A07/MF A01 CSCL 10B

Large-scale wind system and windmill technology and prospects for commercial applications are discussed. Barriers that may affect the commercial viability of large-scale windmill systems are identified, including the relatively poor financial condition of much of the utility industry which effectively prevents many utilities from investing substantially in any new projects. The potential market addressed by the Federal program in large-scale windmill systems is examined. Some of the factors that may limit the degree of market penetration for wind energy systems are: costs of competing fossil and nuclear fuels and technologies, rate of acceptance of new technologies, and competition from other solar technologies, including biomass, solar thermal, and photovoltaic systems. Workshop participants agreed that existing Federal legislation provides significant incentives for the commercialization of large-scale wind machines. GRA

N83-20439# United Technologies Corp., South Windsor, Conn
Power Systems Div
ON-SITE FUEL CELL FIELD TEST SUPPORT PROGRAM Annual Report, May 1980 - Jun. 1981
J. W. STANIUNAS and G. P. MERTEN Jan 1982 199 p refs
Sponsored by Gas Research Inst.
(PB83-121723, FCR-3859; GRI-81/0034) Avail NTIS HC A09/MF A01 CSCL 10B

In order to assess the impact of grid connection on the potential market for fuel cell service, applications studies were conducted to identify the fuel cell operating modes and corresponding fuel cell sizing criteria which offer the most potential for initial commercial service. The market for grid-connected fuel cell service was quantified using United's market analysis program and computerized building data base. Electric and gas consumption data for 268 buildings was added to our surveyed building data file, bringing the total to 407 buildings. These buildings were analyzed for grid-isolated and grid-connected fuel cell service. The results of the analyses indicated that the nursing home, restaurant and health club building sectors offer significant potential for fuel cell service. GRA

N83-20442# Battelle Pacific Northwest Labs., Richland, Wash
ENERGY EFFICIENT INDUSTRIAL TECHNOLOGY IN EUROPE: A COMPENDIUM Interim Report, May 1979 - Feb. 1982
A. G. FASSBENDER and M. J. MCGEE 1 May 1982 160 p
refs Sponsored by Gas Research Inst.
(PB83-102327; BPNL-2311204625, GRI-80/0147) Avail NTIS HC A08/MF A01 CSCL 10A

Energy efficient industrial technologies currently in use in Europe are described. Gas-fired equipment in West Germany, France, and the United Kingdom is emphasized. Some of these technologies are unique and some are currently available in the United States. Load management, cogeneration, heat recovery, and various industrial processes are discussed. GRA

N83-20451# Department of Energy, Washington, D C Office of Policy, Planning and Analysis.
COSTS TO REDUCE SULFUR DIOXIDE EMISSIONS
Mar. 1982 62 p
(DE82-013309, DOE/PE-0042) Avail NTIS HC A04/MF A01

Costs of controlling man-made emissions of chemicals that may cause acid rain are discussed. The position of those who are calling for immediate action and implicating coal fired powerplants as the cause of the problem is examined. The costs of controlling sulfur dioxide emissions using alternative control methods available today are presented. No attempt is made to calculate the benefits of reducing these emissions since insufficient information is available to provide even a rough estimate. Information is presented in two steps. First, costs are presented as obtained through straightforward calculations based upon simplifying but realistic assumptions. Next, the costs of sulfur dioxide control obtained through several large-scale analyses are presented, and these results are compared with those obtained through the first method. DOE

N83-20455# Dames and Moore, Bethesda, Md.
GULF COAST ECOLOGICAL INVENTORY USER'S GUIDE AND INFORMATION BASE
A. D. BECCASIO, N. FOTHERINGHAM, A. E. REDFIELD, R. L. FREW, W. M. LEVITAN, J. E. SMITH, and J. O. WOODROW, JR
Slidell, La Fish and Wildlife Service Aug. 1982 600 p
(Contract DI-14-16-0009-81-063)
(DE83-900406, FWS/OBS-82/55) Avail NTIS HC A25/MF A01

An inventory of important ecological resources along the Gulf coast, an area of some 475,000 square kilometers (183,400 square miles) is given. This inventory is intended to provide government and industry decisionmakers with valuable ecological information which will assist in the regional siting of oil and gas processing and manufacturing facilities and their respective transportation systems. The preparation of this ecological inventory involved four major tasks: the collection, review, and analysis of available data on coastal fish and wildlife species and their habitats and special land use areas; the synthesis and compilation of these data into a format which is compatible with the requirements of 1:250,000 scale mapping. Ecological resources are summarized by their appropriate geographic zone, and descriptions and locations of species with special status and aquatic and terrestrial species of high commercial, recreational, and aesthetic value are included. The designation of more than 270 special land use areas along the Gulf coast also is provided. DOE

N83-20456# Oak Ridge National Lab., Tenn.
MAGNESIA SPRAY ABSORPTION FOR THE REMOVAL OF SO₂ FROM FLUE GAS
L. K. FELKER and B. Z. EGAN 1982 19 p refs Presented at 183 Am Chem Soc Ann Meeting, Las Vegas, Nevada, 27 Mar. 1982
(Contract W-7405-ENG-26)
(DE82-013443, CONF-820304-16-DRAFT) Avail NTIS HC A02/MF A01

Regenerable methods of flue gas desulfurization, which recycle the absorbent and diminish the waste disposal problem, have been developed. One method which substitutes a magnesia (MgO) slurry for the lime/limestone slurry has been under development for

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

several years and commercial systems have been operated. The basic chemical reactions occurring in a magnesia scrubber are known. The magnesia is hydrated in the slurry and the SO₂ in the flue gas reacts to form magnesium sulfite. The magnesium sulfite formed can be dried and subsequently decomposed at higher temperature to yield MgO for recycle to the scrubber, and more concentrated SO₂ for sulfuric acid or sulfur production. Thus, the magnesia FGD system both reduces scrubber sludge disposal and provides for a saleable by-product. Significant advantages could be realized by combining spray absorption technology with the regenerable magnesia flue gas desulfurization system as shown on a simplified flow chart. DOE

N83-20457# Brigham Young Univ., Provo, Utah Combustion Lab

BASIC COMBUSTION AND POLLUTANT-FORMATION PROCESSES FOR PULVERIZED FUELS Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1982

G J GERMANE and L D SMOOT 15 Apr. 1982 50 p refs (Contract DE-FG22-80PC-30306) (DE82-013773, DOE/PC-30306-T6, QTPR-6) Avail: NTIS HC A03/MF A01

Basic combustion and pollution formation processes for pulverized solid fossil fuels is discussed. The fossil fuels under consideration include coal-water mixtures and coal chars derived from pyrolysis, liquefaction or gasification processes. Adaptation of computer code techniques to the combustion of these fossil fuels is discussed. A capillary viscometer was used to measure apparent viscosities of various slurries in order to obtain information for sizing feed lines and determining pressure requirements for transporting slurries from the preparation tank to the reactor burner. The effects of coal type, solids loading and additive concentration for a given particle size distribution on slurry characteristics were studied. A swirl generator for the secondary air stream was designed and fabrication was begun. DOE

N83-20459# Radian Corp., Austin, Tex
ACID RAIN MITIGATION STUDY. VOLUME 1: FGD COST ESTIMATES Final Report, Feb. 1980 - Feb. 1982

J. G BALL and W R MENZIES Sep 1982 164 p refs (Contract EPA-68-02-3171) (PB83-101329; RAD-81-203-001-12-23-VOL-1, EPA-600/2-82-070A-VOL-1) Avail: NTIS HC A08/MF A01 CSDL 13B

Results of work to provide a consistent set of capital investment and operating costs for flue gas desulfurization (FGD) systems retrofitted to existing industrial boilers are given. The investigation of wet limestone scrubbers and lime spray drying FGD systems included: the apparent discontinuities in both FGD system capital investment and operating costs, FGD retrofit factors applied to existing boilers based on published reports; and differences between PEDCo Environmental, Inc. and Tennessee Valley Authority cost estimates for utility boiler FGD systems. These costing issues were examined on the bases of design scope, costing factors (for equipment installation, indirect investment, etc.), year of costs, inherent strengths and weaknesses, and published data of actual system costs. Recommendations are made for the cost bases to use in further acid rain studies. Author (GRA)

N83-20469# Radian Corp., Austin, Tex.
ACID RAIN MITIGATION STUDY. VOLUME 2: FGD COST ESTIMATES, APPENDICES Final Report, Feb. 1980 - Feb. 1981

J. G BALL and W. R MENZIES Sep 1982 228 p refs (Contract EPA-68-02-3171) (PB83-117366; RAD-81-203-001-12-23-VOL-2, EPA-600/2-82-070B-VOL-2) Avail: NTIS HC A11/MF A01 CSDL 13B

Results of work to provide a consistent set of capital investment and operating costs for flue gas desulfurization (FGD) systems retrofitted to existing industrial boilers are given. The investigation of wet limestone scrubbers and lime spray drying FGD systems included the apparent discontinuities in both FGD system capital investment and operating costs, FGD retrofit factors applied to

existing boilers based on published reports; and differences between PEDCo Environmental, Inc. and TVA cost estimates for utility boiler FGD systems. These costing issues were examined on the bases of design scope, costing factors (for equipment installation, indirect investment, etc.), year of costs, inherent strengths and weaknesses, and published data of actual system costs. Recommendations are made for the cost bases to use in further acid rain studies. (GRA)

N83-20511# National Academy of Sciences - National Research Council, Arlington, Va.

MEETING THE CHALLENGE OF CLIMATE Final Report

Jul. 1982 78 p refs

(Contract NA79RA-C-00104)

(PB83-106443) Avail: NTIS HC A05/MF A01 CSDL 04B

The National Climate Program Act of 1978 authorized the establishment of programs of federal and state cooperative activities in climate studies and advisory services. The need for and potential benefits from cooperative activities are examined and documented. Examples of the utility of climate services are provided in the areas of agriculture, water resources, transportation and construction and energy. Provision of climate services by both public and private sector is considered. Recommendations are made for an effective nationwide system of climate services. GRA

N83-20525# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab

DISSOLVED METHANE CONCENTRATIONS IN THE SOUTHEAST BERING SEA, 1980 AND 1981 Data Report

C N. KATZ, J D CLINE, and K KELLEY-HANSEN Jul 1982 200 p refs

(PB83-112433, NOAA-DR-ERL-PMEL-6; NOAA-82092205) Avail: NTIS HC A09/MF A01 CSDL 08J

Tables summarizing dissolved methane concentrations in the Bering Sea are given. The purpose is to identify potential environmental impacts to marine resources prior to the leasing and development of offshore petroleum and gas. These data were collected to assess the spatial and seasonal distributions of methane in order to estimate Lagrangian space scales and the magnitude of diffusive transport processes. GRA

N83-20744# Chem-Nuclear Systems, Inc., Bellevue, Wash
FEASIBILITY OF APPLICATIONS OF MICROWAVE TECHNOLOGY FOR NUCLEAR POWER PLANT RADIOACTIVE WASTES Final Report

J. R. POTTER and A S WOODLE Apr 1982 71 p refs

Sponsored by EPRI

(DE82-903143; EPRI-903143, TPS-80-756) Avail: NTIS HC A04/MF A01

A study into the feasibility of using microwave energy for drying of radioactive wastes is presented. A review of process techniques now in use and proposed is also included and the basics of microwave heating is discussed. A review of tests performed includes: (1) scoping testing, and (2) laboratory testing in batch and continuous feed modes. Finally, a preliminary design is presented for both a batch system and continuous feed system for processing a minimum of 5000 cu ft of ion exchange resin beads per year. DOE

N83-20842# California Univ., Livermore. Lawrence Livermore Lab. Transportation Systems Research Dept.

ROUTE PROFILE ANALYSIS TO DETERMINE SUITABILITY OF ELECTRIC POSTAL-DELIVERY VEHICLES

C E WALTER, M K KONG, and D J MULLENHOFF 14 Dec 1981 15 p refs

Presented at the 32nd Inst. for Elect and Electron. Engr Vehicular Technol Conf., San Diego, Calif., 23 May 1982

(Contract W-7405-ENG-48)

(DE82-012216, UCRL-86707, CONF-820531-1) Avail: NTIS HC A02/MF A01

An instrumentation system and computer program were developed that allow the US Postal Service to determine which

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

postal routes are suitable for electric delivery vehicles. The instrumentation system provides route data. The route data and electric vehicle characteristics are used in the computer program to calculate vehicle energy and power requirements for the particular route. The performance characteristics of electric vehicles are contained in an input data file to the computer program. The instrumentation system is designed for use during normal mail delivery with gasoline-powered vehicles. The system is powered by the vehicle battery. Minimum operator interaction and inexpensive maintenance free sensors are featured in the design. Route grade is determined from a pendulum measurement corrected for vehicle acceleration. Acceleration is determined from a measurement of the distance traveled. DOE

N83-20844# South Coast Technology, Inc., Ann Arbor, Mich
REVIEW AND EVALUATION OF AUTOMOTIVE FUEL CONSERVATION TECHNOLOGIES Final Report

H. M. SIEGEL, R. SCHWARZ, J. ANDON, G. KOLLARS, T. GERSTENBERGER, R. GAINES, R. FALK, and S. RENICK
Washington DOT Dec 1981 267 p
(Contract DOT-HS-9-02111)
(PB83-101139, DOT-HS-806-107) Avail: NTIS HC A12/MF A01
CSCL 13F

Automotive fuel economy and related safety issues were studied. Consumption estimates of stratified charge rotary engines installed in five vehicles were investigated. Oldsmobile Omega X Body Baseline Weight Data, GM X body Material Substitution Weight Reduction/Cost Effectiveness Study, Calspan RSV Restraint System Cost Study, FMVSS No. 208 Extension to Light Trucks, Vans, and MPV's - Cost Lead Time study, Multipiece Rims for Trucks, Buses, and Trailers, Identifying Design Changes, Cost Impacts and Manufacturing Lead Times to Upgrade FMVSS 114 for Passenger Cars, Trucks, and MPV's, Ford Escort GL Baseline Weight Data. Automobile body weight reduction and cost effectiveness studies were made. Restraint systems and design changes, were considered in relation to costs and manufacturing impacts. Passenger cars, trucks, buses, and trailers were considered. GRA

N83-20845# Corporate-Tech Planning, Inc., Waltham, Mass
REVIEW AND EVALUATION OF AUTOMOTIVE FUEL TECHNOLOGIES. VOLUME 1: SUMMARY Final Report, Mar. 1979 - Sep. 1981

T. TAYLOR, JR. Washington DOT Dec 1981 89 p 2 Vol.
(Contract DOT-HS-9-02119)
(PB83-101147, DOT-HS-806-188-VOL-1) Avail: NTIS HC A05/MF A01 CSCL 13F

The impact of automotive technologies and the manufacturer's overall product plans on fuel economy requirements was assessed. Automotive technology, manufacturing costs, and industry assessments were analyzed. Specific subject areas of investigation include: potential fuel economy improvements from variable valve timing of internal combustion engines; effects of tire under inflation on fuel economy; reductions in engine friction; automotive applications of metal/plastic laminates as a substitute material; cost, weight and material analyses of light truck; design, cost and weight analyses of truck-trailer rear underbody guards, the impact of seat belts comfort and convenience on vehicle manufacturing, design modifications and manufacturing costs of child seat tether anchorages, and identification of auto manufacturer's technical progress in weight reduction through material substitution and component redesign. GRA

N83-21156# Department of Energy, Bartlesville, Okla. Energy Technology Center
WASTE LUBRICATING OIL: AN ANNOTATED REVIEW, 1982 REVISION

F. O. COTTON Oct 1982 277 p refs Revised
(DE83-001439, DOE/BETC/IC-82/4-REV) Avail: NTIS HC A13/MF A01

Because of renewed interest in waste oil, both in terms of energy conservation and as a threat to the environment, there appears to be a need for a systematic compilation of information

on the subject. This is a revision of the 1979 manuscript (BETC/IC-79/4) reflecting publications of the last three years as well as incorporation of papers that were overlooked. The number of citations has jumped from 486 to 1203, with all previous citations also listed here. The bibliography is divided into broad subject areas. The introduction gives the history and development of the used oil reclamation industry. The general section includes the comprehensive papers that address several subjects and thus, give a capsulated overview of the used oil situation. Sources of information and statistical treatments of data tell how to obtain additional and future information and data relating to waste oil and could aid those persons interested in keeping their knowledge current. The other lubricating oils section covers many of the lubricants that have the potential for recycling. The other oils section is divided into four sub-sections to aid the reader to find the subject of interest. The section on related subjects includes those sideline areas that could apply to used oil reclamation. DOE

N83-21168# California Univ., Irvine Lab. for Sanitary Engineering and Environmental Health.

ENVIRONMENTAL QUALITY RESEARCH: FATE OF TOXIC JET FUEL COMPONENTS IN AQUATIC SYSTEMS Annual Report, 1 Jun. 1981 - 31 Aug. 1982

R. C. COOPER, L. HUNTER, P. C. ULRICH, and R. DANIELSON Wright-Patterson AFB, Ohio AFAMRL Oct 1982 101 p refs
(Contract F33615-80-C-0512; AF PROJ 6302)
(AD-A122548, AFAMRL-TR-82-64) Avail: NTIS HC A06/MF A01 CSCL 06T

This report describes an investigation into the nature of the toxic components in the jet fuel JP-4. Toxicity evaluation was based on the inhibitory effect of the fuel water soluble extract (WSF) on the hatchability of *Artemia salina* eggs. JP-4 samples from different sources were shown to differ substantially both in hydrocarbon composition and toxicity. Toxicity tests with individual model hydrocarbons and mixtures indicated that (1) contrary to widely held views, alkane hydrocarbons were substantially (20-50 times) more toxic than aromatics; (2) the major WSF components benzene, toluene, and xylenes (70-90% of total) accounted for less than 30% of WSF toxicity, and (3) the estimated toxicity of the remaining WSF hydrocarbons was high enough (approximately 2 ppm) to account for the rest of the WSF toxicity. It was concluded that all the JP-4 hydrocarbons were toxic, their contribution being dependent on the proportion present in the water soluble fraction, and that JP-4 toxicity was the sum of the toxicities of its component hydrocarbons. Least squares plots have been developed that allow prediction of maximum JP-4 WSF toxicities from: (1) benzene/toluene levels in the neat fuel and; (2) total hydrocarbon levels in the WSF. Author (GRA)

N83-21187# National Science Foundation, Washington, D.C. Div. of Research Policy and Analysis

WORKSHOP ON THE FEDERAL ROLE IN SYNFUELS DEVELOPMENT

1982 575 p Workshop held in Washington, D.C., 11-12 May 1981
(PB83-102236; NSF/PRA-82010; NSF-82-45) Avail: NTIS HC A24/MF A01 CSCL 21D

Answers are offered to the question: How large an investment in the synthetic fuels program is appropriate? Substantial learning and information benefits from a small synfuels program are identified and it is noted that a large synfuels program does not make sense unless synfuels costs are very low and oil costs are very high. Political considerations and Federal funding constraints connected with the issues of the synfuels program are considered. The lack of any cooperative trust between industry and government is said to be a significant problem for the development of synthetic fuels. The economic problem of timing the synfuels program correctly is addressed. If there is too great a supply of synfuels too soon, synfuels will not be priced competitive. Conversely, if the supply is too little and too late, there will be a serious shortage. The lack of any technology-specific environmental requirements

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

for the synfuels industry is noted and a joint review process is suggested to speed up the permit process. Author (GRA)

N83-21201# Los Alamos Scientific Lab., N. Mex
THE APPLICATION OF DOE-2 IN THE PREDESIGN PHASE OF COMMERCIAL-BUILDING DESIGN
 J L PETERSON and B D HUNN 1982 7 p refs Presented at the Renewable Challenge Solar Technol. Conf and Intern Exposition, Houston, Tex., 1-5 Jun 1982
 (Contract W-7405-ENG-36)
 (DE82-014067, LA-UR-82-989; CONF-820629-8) Avail NTIS HC A02/MF A01

The results of a study in applying a high level, computer dynamic tool, DOE-2 was applied to the predesign process for a standard test office building. Five analysis tools, ranging from manual to computer dynamic methods, were used to provide predesign energy information. Computer dynamic tools, such as DOE-2 and BLAST were tested to determine if they can readily provide the necessary predesign information in a usable visual format and without excessive cost. DOE

N83-21501# Central Electricity Generating Board, London (England)
NUCLEAR POWER COMPARED WITH OTHER ENERGY SOURCES: A BRIEF COMPARATIVE STUDY OF SOME OF THE RISKS
 P. WIBLE 26 Oct 1983 24 p refs Transl into ENGLISH of report from Federation Romande pour l'Energie Lausanne, Switzerland, 1980 20 p
 (BLL-CE-TRANS-7745-(9022.09)) Avail British Library Lending Div., Boston Spa, Engl

Some of the risks involved in the major energy sources were studied. Author

N83-21525# Colorado State Univ., Fort Collins Dept of Atmospheric Science
THE EFFECTS OF ATMOSPHERIC VARIABILITY ON ENERGY UTILIZATION AND CONSERVATION Progress Report
 E. R. REITER, J. D. SHEAFFER, J. W. MIDDLETON, and A. F. HANNA Aug 1982 155 p refs
 (Contract DE-AC02-76EV-01340)
 (DE83-003612, DOE/EV-01340/4) Avail NTIS HC A08/MF A01

Teleconnections between precipitation surges in the equatorial Pacific, which are tied to the negative phase of the southern oscillation, and midlatitude planetary wave patterns are described. These connections are also evident in long term trend patterns of the winter time midlatitude circulation. Statistically significant planetary wave pattern differences between wet and dry monsoon summers exist in midlatitudes already several months prior to the onset of the monsoon. Numerical model indicate that the frequency of the quasi-biennial oscillation can be modulated by variable momentum fluxes in the tropics. Planetary wave pattern variability is significantly influenced by variations in heat source and sink distributions at the Earth's surface. This fact is demonstrated by experiments with a simple, two layer, nonlinear, quasigeostrophic global general circulation model. Preliminary tests of this model were restricted to changes in sea surface temperature anomalies. A heat budget equation was tested to estimate the effects of changes in the surface energy budget on continental surface temperature anomalies. The modelling of urban and regional energy demand as a function of weather variability is summarized. DOE

N83-21536# Department of Energy, Washington, D. C. Assistant Secretary for Conservation and Renewable Energy
US HEAT-PUMP RESEARCH AND DEVELOPMENT PROJECTS
 Aug 1982 176 p
 (DE83-000943, DOE/CE-0035) Avail: NTIS HC A09/MF A01

A compilation of 153 research project summary forms which provide descriptive data about individual R and D projects is provided. The document is intended to include all heat pump projects for which results are publicly available. DOE

N83-21538# Argonne National Lab., Ill. Energy and Environmental Systems Div

A TECHNOLOGY ASSESSMENT OF SOLAR ENERGY SYSTEMS. DIRECT COMBUSTION OF WOOD AND OTHER BIOMASS IN INDUSTRIAL BOILERS

H. I. ABELSON, L. J. HABEGGER, and B. C. LIU Dec. 1981 33 p refs
 (Contract W-31-109-ENG-38)
 (DE83-000937; ANL/EES-TM-189) Avail: NTIS HC A03/MF A01

The cost, resource requirements, and environmental characteristics of a model combustion system sized to handle an annual feed of 12,500 dry tons of forest residue were evaluated. The cost of the wood combustion system is comparable to that of coal fired boilers in industry. Atmospheric emissions of the wood system are lower in sulfur dioxide than those of coal systems, but emissions of particulate matter are potentially higher. The combined use of multicyclones and wet scrubbers, however, can reduce these emissions to levels produced by coal systems. Cost and environmental characteristics of boilers that burn sugarcane bagasse are compared to those of wood fired boilers because the two systems are similar. DOE

N83-21543# JBF Scientific Corp., Wilmington, Mass
FEDERAL APPLICATIONS FOR WIND ENERGY SYSTEMS. A SUBCONTRACT REPORT

J. E. WILSON, R. L. SCHREIBER, R. NEAL, N. BERUBE, and G. C. HEFFNER 1982 131 p refs
 (Contract DE-AC02-77CH-00178, EG-77-C-01-4042)
 (DE83-000306; SERI/STR-211-1707) Avail: NTIS HC A07/MF A01

The Federal Applications Study of wind energy systems performed the following functions: surveyed potential applications and sites where wind power could be used by Federal facilities for electricity production, analyzed the current cost competitiveness of both small and large wind energy conversion systems (WECS) for use by Federal agencies, identified those sites where WECS are currently economically competitive with the marginal costs of new conventional energy sources, identified promising Federal applications for further consideration by the appropriate agency, case studies of two sites which are typical of promising Federal applications, and provided planning guidelines for those agencies interested in implementing wind energy programs or systems at their facilities. The approach of data collection which are needed for the economic evaluations is described. Categories of data collected are site specific electrical load and wind resource data, and wind system performance data and economic parameters. The results of preliminary screening and of the detailed analysis and case studies are reported. DOE

N83-21545# Geothermal Development Associates, Reno, Nev
GEOHERMAL ENERGY IN NEVADA: DEVELOPMENT AND UTILIZATION

1982 24 p refs
 (Contract DE-FC03-80RA-50075)
 (DE83-001783, DOE/RA-50075/T14) Avail: NTIS HC A02/MF A01

The nature of geothermal resources in Nevada and resource applications are discussed. The social and economic advantages of using geothermal energy are outlined. Federal and state programs established to foster the development of geothermal energy are discussed. DOE

N83-21552# Science Applications, Inc., La Jolla, Calif.
USER'S MANUAL FOR HEAT-PUMP SEASONAL-PERFORMANCE MODEL (SPM) WITH SELECTED PARAMETRIC EXAMPLES

30 Jun 1982 92 p refs
 (Contract DE-AC01-79CS-10757)
 (DE83-002455, SAI-444-82-141-LJ, TRT-3) Avail: NTIS HC A05/MF A01

The Seasonal Performance Model (SPM) was developed to provide an accurate source of seasonal energy consumption and

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

cost predictions for the evaluation of heat pump design options. The program uses steady state heat pump performance data obtained from manufacturers' or Computer Simulation Model runs. The SPM was originally developed in two forms - a cooling model for central air conditioners and heat pumps and a heating model for heat pumps. The original models have undergone many modifications, which are described, to improve the accuracy of predictions and to increase flexibility for use in parametric evaluations. Insights are provided into the theory and construction of the major options, and into the use of the available options and output variables. Specific investigations provide examples of the possible applications of the model. DOE

N83-21553# Science Applications, Inc., La Jolla, Calif.
USER'S MANUAL FOR STEADY-STATE COMPUTER SIMULATION FOR AIR-TO-AIR HEAT PUMPS WITH SELECTED EXAMPLES

30 Jun. 1982 89 p refs
(Contract DE-AC01-79CS-10757)
(DE83-002446, SAI-444-82-140-LJ, TRT-3) Avail. NTIS HC A05/MF A01

A steady-state computer simulation model was developed for conventional, vapor compression cycle, electrically driven air-to-air heat pumps. Comparison between the heat pump simulation model predictions and available data from three heat pump experiments indicate that the predictions generally are within accepted tolerance. A sensitivity analysis was made to assess the effect of possible variations in some of the input parameters on the system's thermal performance. The computer simulation model input data and output are given. DOE

N83-21559# Science Applications, Inc., La Jolla, Calif.
PROGRAM LISTING FOR AIR-TO-AIR HEAT PUMP STEADY-STATE COMPUTER-SIMULATION MODE (CSM)

30 Jun 1982 141 p refs
(Contract DE-AC01-79CS-10757)
(DE83-002549, SAI-444-82-142-LJ) Avail. NTIS HC A07/MF A01

The computer program HPCSM is listed which computes steady state performance of an air-to-air heat pump in the cooling and heating mode using compressor performance maps. DOE

N83-21561# Governor's Div of Energy Resources, Columbia, SC

SOUTH CAROLINA ENERGY OUTLOOK

1982 222 p refs
(Contract DE-FG44-78CS-60055)
(DE83-002121; DOE/CS-60055/T2) Avail. NTIS HC A10/MF A01

This long-range energy outlook study describes current energy supply and demand and presents forecasts of energy demand through the year 1995. The trends and forecasts are analyzed, and resulting policy and program recommendations are made. DOE

N83-21572# Oak Ridge National Lab., Tenn.
USE OF VEGETATION TO AMELIORATE BUILDING MICROCLIMATES: AN ASSESSMENT OF ENERGY-CONSERVATION POTENTIALS

B. A. HUTCHISON, F. G. TAYLOR, and R. L. WENDT Apr. 1982 83 p refs
(Contract W-7405-ENG-26)
(DE82-013255; ORNL/CON-87) Avail. NTIS HC A06/MF A01

The space-conditioning energy conservation potentials of landscapes designed to ameliorate building microclimates are evaluated. The physical bases for vegetative modifications of climate are discussed and results of past study of the effects of vegetation on space-conditioning energy consumption in buildings are reviewed. The state-of-the-art of energy-conserving landscape designs is assessed and recommendations are presented for further research. DOE

N83-21578# Hague International, South Portland, Maine
ENHANCEMENT OF ENERGY SAVINGS THROUGH ACCELERATED IMPLEMENTATION OF HIGH-PERFORMANCE FORGE FURNACES Final Technical Report

Feb 1982 138 p refs
(Contract DE-FC01-80CS-40335)
(DE82-010913; DOE/CS-40335/T1) Avail. NTIS HC A07/MF A01

Hague International successfully demonstrated under both controlled and actual production conditions that a well designed slot forge furnace equipped with a ceramic recuperator could consume as much as 65% of the fuel normally consumed by a forging furnace. Thus the Department of Energy, entered into a cooperative agreement to accelerate the introduction of Hague International's high efficiency slot forge furnace into the forging industry. This report details the basis of the cooperative agreement and the history of the host sites covered by the agreement. Fifteen (15) host sites participated in the program. DOE

N83-21593# Oregon Inst. of Tech., Klamath Falls. Geo-Heat Center.

DISTRICT-HEATING SYSTEM, LA GRANDE, OREGON

Jan 1982 27 p refs
(Contract DE-FG06-79ET-27256)
(DE82-015102; DOE/ET-27256/T26) Avail. NTIS HC A03/MF A01

The area suggested for district heating feasibility study encompassed slightly over 400 acres extending north and south from the geographic center of the city. This district was subdivided into 8 areas, which include the Grande Ronde Hospital, Eastern Oregon State College, La Grande school district, one institutional area, one commercial area and three residential areas. Basic space heating loads developed for the various areas after a survey by county personnel and computation using a computer program form the basis for this economic feasibility study. DOE

N83-21597# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

THE ACQUISITION OF WIND RIGHTS FOR WIND ENERGY DEVELOPMENT

R. J. NOUN Mar. 1982 9 p refs. Presented at the Wind/Solar Energy Conf., Kansas City, Mo., 5-7 Apr. 1982
(Contract DE-AC02-77CH-00178; EG-77-C-01-4042)
(DE82-009139; SERI/TP-254-1421R, CONF-820423-1) Avail. NTIS HC A02/MF A01

Identifying suitable sites for large wind machine clusters, or wind farms, requires more than finding a location with an adequate wind resource. Consideration must also be given to the question of how land use policies and regulations will affect the siting of wind system installations. In particular, the issue of acquiring wind rights or guaranteed access to the wind resource for electric power generation, will be vital to the development of wind energy. Several methods are examined for acquiring and preserving access to the wind resource and for dealing with related land use issues. DOE

N83-21610# Louisiana State Univ., Baton Rouge.
USE OF TWIN WELLS AND WATER-SOURCE HEAT PUMPS FOR ENERGY CONSERVATION IN LOUISIANA

R. G. KAZMANN Dec 1981 73 p refs
(DE83-900349, NP-3900349; TR-9) Avail. NTIS HC A04/MF A01

The use of heat pumps and well water for energy conservation, is both safe and feasible in Louisiana. Two wells should be used alternately as the water source: one for production, one to return the water to the aquifer. The purpose is to eliminate any impact on ground-water levels and to prevent interference with other uses of the same aquifer. Tables are included for determining the spacing between the production and return wells for any combination of aquifer thickness, length of season, and rate of water production, so that returned water will not appear in the production stream. Economic analyses include residential, commercial and industrial applications for two parishes in Louisiana. All hydrogeological data needed for preliminary design are shown on maps. DOE

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-21611# Oak Ridge National Lab, Tenn Energy Div ADIABATIC ABSORPTION AND DESORPTION FOR IMPROVEMENT OF TEMPERATURE-BOOSTING ADSORPTION HEAT PUMPS

G. GROSSMAN Nov 1982 19 p refs
(Contract W-7405-ENG-26)

(DE83-002589; ORNL/TM-8390) Avail NTIS HC A02/MF A01

An improvement is reported in the conventional absorption heat pump cycle that allows for achieving an increased temperature boost and a better coefficient of performance (COP). The improvement is obtained by adding adiabatic absorption and desorption steps to the absorber and desorber of the system, respectively. The adiabatic processes make it possible to obtain the highest possible temperature in the absorber before any heat is removed from it and the lowest temperature in the desorber before heat is added to it. This, in turn, allows for efficient utilization of the thermodynamic availability of the heat supply stream. Compared to the conventional cycle, the improved system can operate with a larger difference between the high and low concentrations, less circulation losses, and a more efficient heat exchange. The concept of adiabatic absorption and desorption is described and compared for the conventional and improved cycles. Mathematical expressions are derived for the conditions at the adiabatic points, and design considerations are described for incorporating the improvements in a conventional system. Computer-generated performance curves of COP versus temperature boost are given for the heat pump to illustrate the performance enhancement by the diabatic process. DOE

N83-21612# Science Applications, Inc., La Jolla, Calif. PROGRAM LISTING FOR HEAT-PUMP SEASONAL-PERFORMANCE MODEL (SPM)

30 Jun 1982 130 p refs

(Contract DE-AC01-79CS-10757)

(DE83-002436; SAI-444-82-143-LJ) Avail NTIS HC A07/MF A01

The computer program CNHSPM is listed which predicts heat pump seasonal energy consumption (including defrost, cyclic degradation, and supplementary heat) using steady state rating point performance and binned weather data. DOE

N83-21616# Syracuse Research Corp., N Y Energy Research Center

EXTERIOR INSULATING SHUTTER FINAL PROTOTYPE DESIGN Final Report

G A DIKE and L F KINNEY Dec 1982 123 p

(Contract DE-FC02-80CS-30584)

(DE83-004520; SRC-TR-82-862; DOE/CS-30584/2) Avail NTIS HC A06/MF A01

The final prototype shutter described uses sliding panels composed of inch thick thermax sandwiched between 60 mil thick ultraviolet resistant plastic on the outside, and 20 mil styrene on the inside. The shutter system was shown to have an effective R value of 6 using ASHRAE procedures to convert from still air conditions to 15 mph wind conditions in a simulated cold environment. Tests were performed for cyclical operation, vulnerability to ice and wind, thermal performance, and air infiltration. Marketing efforts are described. Cost effectiveness is determined via present value analysis. DOE

N83-21617# California Univ., Berkeley Lawrence Berkeley Lab Building Ventilation and Indoor Air Quality Program

RESIDENTIAL AIR-TO-AIR HEAT EXCHANGERS: A STUDY OF THE VENTILATION EFFICIENCIES OF WALL- OR WINDOW-MOUNTED UNITS

F J OFFERMAN, W J FISK, B PEDERSEN, and K L REVZAN
Sep 1982 41 p refs

(Contract DE-AC03-76SF-00098)

(DE83-004752; LBL-14358; EEB-VENT-82-14) Avail NTIS HC A03/MF A01

Mechanical ventilation systems with air-to-air heat exchangers can be installed into residences to provide energy efficient supplementary ventilation for the purpose of controlling indoor

concentrations of contaminants, odors, and moisture. Wall or window-mounted units are particularly attractive because they are relatively inexpensive and easy to install. However, because they lack an air distribution system, concern arose over their ventilation performance. To address this concern, a series of experiments was conducted on two different models of wall- or window-mounted heat exchangers in two multi-room research facilities. The nominal ventilation efficiencies of these units was determined by measurement of tracer gas decay rates at several indoor locations to be in the range of 0.44 or 0.65. No significant correlations between nominal ventilation efficiency and heat exchanger model or operational strategies were observed. Significantly higher local ventilation efficiencies were noted in the rooms where the heat exchangers were operating. Some preliminary tests indicate that internal leakage between the airstreams contributes significantly to the ventilation inefficiency of these systems. DOE

N83-21619# National Academy of Sciences - National Research Council, Washington, D. C Committee on Satellite Power Systems

ELECTRIC POWER FROM ORBIT: A CRITIQUE OF A SATELLITE POWER SYSTEM

National Academy Press 1981 357 p refs

(Contract DE-AI01-80ER-10159; NSF PRM-81-83080)

(DE83-002771; DOE/ER-10159/T1, LC-81-83080,

ISBN-0-309-03183-4) Avail NTIS HC A16/MF A01

A Satellite Power System (SPS) which would consist of a number of huge satellites moving in geosynchronous orbit and collecting solar energy for conversion and transmission to Earth is outlined. Focussing on a reference system, the concept is critiqued in terms of technological aspects, economic aspects, environmental effects, sociopolitical factors, comparison with other long term technologies. It is recommended that no funds be committed to developing an SPS, but that progress in new technologies that would be important to the practicality and timeliness of an SPS should be reviewed and reported to Congress. Supporting information is included on space systems, solar cells, microwave energy transmission, dosimetry, long term effects of low level radiation on people, and electromagnetic compatibility. DOE

N83-21630# Oak Ridge National Lab, Tenn Energy Div. PERFORMANCE AND ECONOMICS OF 8 ALTERNATIVE SYSTEMS FOR RESIDENTIAL HEATING, COOLING, AND WATER HEATING IN 115 US CITIES

E A NEPHEW and L A ABBATIELLO Nov 1982 249 p refs

(Contract W-7405-ENG-26)

(DE83-003196; ORNL/CON-89) Avail NTIS HC A11/MF A01

The effects of 1981 costs and technology on the performance and economics of five electrically driven heating, ventilating, air-conditioning, and water-heating systems for residences are discussed. Current life-cycle costs and annual efficiencies are presented for 115 cities in the United States for each of the following residential systems: an electric furnace, central air conditioner, and electric resistance water heater, a high-performance air-to-air heat pump with electric resistance water heater, a high-performance air-to-air heat pump with desuperheater water heater, a minimum annual cycle energy system (ACES) of the brine-chiller type, a full ACES of the brine-chiller type, an advanced gas furnace, central air conditioner, and gas water heater, an oil furnace, central air conditioner, and electric resistance water heater, and a pulse gas furnace, central air conditioner, and gas water heater. Of the electrically driven systems, the full ACES is found to exhibit the highest annual efficiency and the highest life-cycle costs for most regions of the nation. The gas furnace system generally exhibits lower life-cycle costs. DOE

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-21638# Mitre Corp., McLean, Va.
NATIONAL IMPLICATIONS OF HIGH SOLAR AND BIOMASS ENERGY GROWTH. A TECHNOLOGY ASSESSMENT OF SOLAR ENERGY SYSTEMS. THE TASE PROJECT Final Report
 Y M SCHIFFMAN and G. DALESSIO Sep 1982 455 p refs
 (Contract DE-AC01-80EV-10354)
 (DE83-004935; MTR-82W54) Avail: NTIS HC A20/MF A01

A comprehensive multi-year analysis of the environment, resource and community impacts which could result in the year 2000 if major national of solar and biomass units, and the potential reductions in the impacts of new conventional technologies which they would displace. In addition, the indirect pollution impacts associated with the manufacturing of solar systems at greater and lesser rates are discussed. Overall, massive incentives for solar and biomass energy over the next 20 years can lead to major stress on national capital and finished materials resources as well as to significant air pollution and safety problems. Rapid growth rates for solar systems could markedly increase energy demand in the manufacturing sector. The capital resource and materials problems would derive from emphasis on high, near term growth of solar technologies. DOE

N83-21650# Virginia Polytechnic Inst and State Univ, Blacksburg.
 Virginia Center for Coal and Energy Research
ACID PRECIPITATION: A CRITIQUE OF PRESENT KNOWLEDGE AND PROPOSED ACTION
 W R HIBBARD, JR 1 Jun 1982 34 p refs
 (DE83-900303; VPI/CER-3900303) Avail: NTIS HC A03/MF A01

This study surveys the evidence, describes the situation, and proposes recommendations to reduce acid precipitation in a cost effective way. Acid precipitation is damaging to the ecology and is present in many areas. Possible sources of acid precipitation are identified, but their specific role and effects have not yet been resolved in an unambiguous manner. Research is needed to determine the mechanism of acid transformation, transport and disposition so that the role of various sources can be evaluated and the most cost effective counter measures chosen. The effects of actual acid precipitation on forests, vegetation, fish, lakes and ecology are real, but not as bad as originally thought nor does the acidification seem to be changing very quickly. Current legislation, focused on sulfur dioxide emissions from coal burning utilities, will cost \$2 to \$6 billion per year and will be paid for primarily by utility customers in 10 states. The benefits of this legislation are not at all certain. Sulfur dioxide reduction in Japan did not control acid precipitation, for example. It is highly probable that local sources are a significant cause of acid precipitation, and these sources are not addressed by the legislation. DOE

N83-21651# UOP, Inc., McLean, Va.
PRELIMINARY EVALUATION OF ENVIRONMENTAL ISSUES ON THE USE OF PEAT AS AN ENERGY SOURCE
 R KING, S RICHARDSON, A. WALTERS, L BOESCH, W THOMSON, and J IRONS 14 Mar 1980 304 p refs
 (Contract DE-AC01-78ET-10159, ET-78-C-01-3117)
 (DE83-000820, DOE/ET-10159/T21, TR-80/025-001) Avail: NTIS HC A14/MF A01

The environmental effects, that could arise from an extensive peat utilization program were studied. The objectives of this report are to identify the environmental issues and potential problems, examine the significance of issues in the geographical regions where peat use could be developed, and establish a methodology by which issues can be resolved or clarified through future coordinated private, state, and federal programs. An overview of peat development of conversion technologies, extraction and harvesting procedures, and land reclamation is presented. Environmental concerns concerning water resources and quality, air quality, health and safety issues, solid waste management, and land reclamation are discussed. The general environmental issues, resources availability, and attitudes toward potential peat development in 10 states, containing an estimated 90% of US peat resources were described. The 10 states reviewed are

Alaska, Minnesota, Michigan, Maine, North and South Carolina, Wisconsin, New York, Florida, and Louisiana (DMC) DOE

N83-21666# Texas Univ, Austin. Center for Energy Studies.
FUTURE LANDSCAPES OF THE COLORADO PLATEAU: IMPACTS OF ENERGY DEVELOPMENT
 W E DEBUYS, JR and R. W. DOUGHTY Jul 1982 127 p refs
 (DE83-900473, UT/CES-PS-19) Avail: NTIS HC A07/MF A01

The transformations taking place on the Colorado Plateau in the areas of mine reclamation, wildlife protection, surface and groundwater allocation, air quality management, and boomtown growth are discussed. These subjects are treated in a unified fashion as constituent elements of a single entity called the cultural landscape. That term refers not only to the geophysical realities of topography, vegetation, and animal life, but also to the cultural realities of man's impact on environment and on himself. By taking this holistic approach, an attempt is made to render a more complete and balanced portrait of the region's future than one usually finds in the literature of impact assessment. DOE

N83-22179# Civil Aviation Authority, London (England)
FUEL CONSERVATION AND ECONOMY CONSTRAINTS
 D. BARBER and J. C. MORRALL In AGARD Air Traffic Control in Face of Users' Demand and Econ Constraints 8 p Feb. 1983
 Avail: NTIS HC A06/MF A01

Fuel conservation in civil aviation may be achieved by increasing the efficiency of the aircraft themselves, by operating the aircraft more efficiently, and by providing them with a more efficient air traffic environment. Three aspects are discussed briefly, and possible improvements in the air traffic management environment are examined in more detail. Finally, attention is drawn to the Research and Development program needed to achieve fuel conservation by improved air traffic management. Author

N83-22486# Institution of Engineers, Calcutta (India).
SEMINAR ON USE OF HIGH STRENGTH DEFORMED BARS
 Apr. 1981 90 p refs Proceedings of Seminar held at Nagpur, India, 11-12 Apr 1981
 (PB83-122580) Avail: NTIS HC A05/MF A01 CSCL 13C

Steel requirements, cost and energy for two lane curved and straight bridges for 20 m span are studied. Saving in steel cost and energy by using high strength bars is also discussed. Only 20 m span, straight simply supported and 5 deg, 10 deg and 15 deg curved simply supported bridges are considered. The width of bridge is taken as 7.8 m. Bridges are designed with steel stresses 1900 kgs/cm sq, 2100 kgs/sq cm and 2500 kgs/sq cm and saving in steel, cost and energy is given. GRA

N83-22673# New Mexico Energy and Minerals Dept., Santa Fe
ROLE OF ENERGY RESOURCES IN NEW MEXICO
 In its Energy Resources in New Mexico p 13-16 1982
 Avail: NTIS HC A05/MF A01

The development of energy resources, particularly oil and gas, has contributed a major share of New Mexico's revenues and provided a predominant component of the economic base. The dependency of the development of what was considered abundant resources was the basis for economic growth and stability. This dependency may be disruptive to the future economic stability, and if a diversification of the economy does not take place, the state may be in danger of approaching the future without a strong economic base. BG

N83-22674# New Mexico Energy and Minerals Dept., Santa Fe.
OIL AND GAS
 In its Energy Resources in New Mexico p 17-36 1982
 Avail: NTIS HC A05/MF A01

New Mexico's crude oil and natural gas reserve base was never fully identified. Variation was due to the methods used for calculation, differing geological and engineering approaches in assuming recovery, and agency reporting. Assessment of the reserve base was determined by adding a conservative estimate

of gas available from infill drilling on developed acreage as well as adding conservative estimates of gas available in undeveloped acreage. B G

N83-22702# Oak Ridge National Lab., Tenn Environmental Sciences Div

CARTOGRAPHIC EVALUATION OF ENVIRONMENTAL-MANAGEMENT STRATEGIES

J. C. GOYERT, K. L. DANIELS, R. STRAND, and M. P. FARRELL
1982 15 p refs Presented at the SAS Users Group Intern Meeting, San Francisco, 14 Feb 1982
(Contract W-7405-ENG-26)

(DE82-009828; CONF-820219-4) Avail NTIS HC A02/MF A01

A complex problem in environmental research is the evaluation of the effects of various environmental management strategies at regional, ecosystem, population and community levels. The large amount of data are presented in a form that allows decision makers at state or federal levels to knowledgeably act on the information. A series of computer-generated maps with increasing levels of resolution can be used to summarize these data and more clearly illustrate the potential effects of various decision alternatives. A number of graphic displays are presented to illustrate how policy decisions concerning California water allocation can affect salinity distribution and aquatic plant communities in San Francisco Bay. The graphic displays include a coordinate map for the regional level, bench digitized coordinate map for the ecosystem level, and a program generated coordinate map for the community level. DOE

N83-22737# British Library Lending Div., Boston Spa (England). **HIGHER LEVEL OF UTILIZATION OF FUEL-ENERGY RESOURCES**

A. P. PETRAKOVSKII and G. P. AFANSEV 20 Dec. 1982 7 p
Transl into ENGLISH from Stal (USSR), v. 12, 1981 p 7-8
(BLL-M-26855-5825.4) Avail British Library Lending Div., Boston Spa, Engl

Measures taken to achieve economies in fuel and power utilization, mainly during the 10th five year plan are reviewed, with particular reference to the use of secondary fuel energy resources and their prospective utilization in the region during the period 1981-1985. Author

N83-22752# Committee on Energy and Commerce (U. S. House).

COGENERATION AND SMALL POWER PRODUCTION

Washington GPO 1982 383 p refs Hearing on H.R. 6500 before the Subcomm on Energy Conserv. and Power of the Comm on Energy and Com., 97th Congr., 2d Sess., 15 Jun 1982
(GPO-99-464) Avail Subcommittee on Energy Conservation and Power

A Federal legal presumption in favor of the avoided cost rule to govern purchases by utilities from qualifying cogeneration and small power production facilities is proposed. States and nonregulated utilities are authorized to deviate from this rate under certain conditions, and may continue to negotiate and agree to any rate for purchase. On interconnection, the bill would create a Federal duty among utilities to connect their facilities with those of qualifying facilities, subject of course, to the requirement that these facilities pick up the costs for that interconnection. S L

N83-22753# Committee on Energy and Natural Resources (U. S. Senate)

WORLD PETROLEUM OUTLOOK, 1982

Washington GPO 1982 181 p Hearing before the Comm on Energy and Natural Resources, 97th Congr., 2d Sess., 23 Apr 1982

(GPO-95-066) Avail Committee on Energy and Natural Resources

The world petroleum outlook is discussed. The near-term outlook for international supplies of oil are reviewed, and various factors which may affect this supply are explored. Author

N83-22761# University of South Florida, St. Petersburg

SUMMARY OF RECOMMENDATIONS ON BASIC RESEARCH

In its Workshop Rept on Basic Res. in Org. Geochem Appl to Natl. Energy Needs p 1-8 Jan. 1982
Avail NTIS HC A07/MF A01

There has been considerable progress during the past four decades in organic geochemistry research applied to understanding the origin of coal, oil, and gas, and in understanding contemporary and ancient carbon cycles on Earth. Significant contributions have been made by academic research, government laboratories, and industrial research communities either working independently or with informal cooperation. But, important questions still remain. Among the questions answered in this paper are those dealing with the mechanisms of migration of hydrocarbons and the structure of kerogen and coal. During the final plenary session of the workshop, one way of dealing with the problem of coordinating basic research effects between industry, academic institutions, and government laboratories, strongly favored by some of the participants, was discussed--creation of a National Fossil Fuel Research Institute. Author

N83-22782# Delaware Div. of Facilities Management, Dover.

GEOTHERMAL ENERGY: TOMORROW'S ALTERNATIVE TODAY. A HANDBOOK FOR GEOTHERMAL-ENERGY DEVELOPMENT IN DELAWARE

J. MANCUS and E. PERRONE Aug 1982 117 p refs
(Contract DE-FG01-80RA-50091)

(DE83-002987; DOE/RA-50091/T1) Avail NTIS HC A06/MF A01

A general procedure guide to various technical, economic, and institutional aspects of geothermal development in Delaware is given. The following are covered: geothermal as an alternative, resource characteristics, geology, well mechanics and pumping systems, fluid disposal, direct heat utilization-feasibility, environmental and legal issues, permits and regulations, finance and taxation, and steps necessary for geothermal development. DOE

N83-22792# Department of Energy, Oak Ridge, Tenn Technical Information Center.

ENERGYGRAMS: BRIEF DESCRIPTIONS OF ENERGY TECHNOLOGY

W. F. SIMPSON, JR., ed 1982 100 p refs

(DE83-001868; DOE/TIC/EGC-82/3) Avail NTIS HC A05/MF A01

This compilation of technical notes (called Energygrams) is published by the Technical Information Center. Energygrams are usually one-page illustrated bulletins describing DOE technology or data and telling how to obtain the technical reports or other material on which they are based. Frequently a personal contact is given who can provide program information in addition to the data found in the reports. The compilation is organized by subject categories, and, within each category, Energygrams are presented alphabetically by Energygram title. DOE

N83-22800# Los Alamos Scientific Lab., N. Mex Economics Group

ROLE OF WATER IN ENERGY DEVELOPMENT

D. ABBEY, F. ROACH, and L. BROWN (New Mexico Univ) 1982 30 p refs Presented at the Ann Meeting of the Am Assoc for the Adv. of Sci., Washington, D.C., 3-8 Jan. 1982
(Contract W-7405-ENG-36)

(DE82-011986; LA-UR-82-674; CONF-820118-6) Avail NTIS HC A03/MF A01

The physical availability of water and the role of economics in water demand by energy are reviewed. The social mechanisms through which the physical availability of water, the historical pattern of water use, and unresolved water issues combine to constrain and channel the energy industry's use of water are described. These mechanisms include the developing markets for water rights, the legal and administrative structure governing water allocation, the formation of social attitudes about water, and the political process that often implements consensus. DOE

01 ENERGY POLICIES AND ENERGY SYSTEMS ANALYSIS

N83-22801# Sandia Labs., Albuquerque, N. Mex
INDUSTRY/GOVERNMENT FORUM ON RECENT POLICY AND BUDGET CHANGES IN THE DOE SOLAR-THERMAL PROGRAM

L. G. RADOSEVICH, ed. 6 May 1981. 39 p. refs. Forum held at Fredricksburg, Va., 6 May 1981 (Contract DE-AC04-76DP-00789) (DE82-012511, SAND-82-8207) Avail. NTIS HC A03/MF A01

A transcript is presented of an industry/government forum on solar thermal energy. The forum addressed recent policy and budget changes and their effect on the solar thermal program.

DOE

N83-22802# Sandia Labs., Albuquerque, N. Mex
PERSPECTIVE ON OUR ENERGY OPTIONS

J. H. SCOTT. 1982. 10 p. refs. Presented at Spring Meeting for the Soc. for the Adv. of Mater. and Process Engr., San Diego, Calif., 4 May 1982 (DE82-005828; SAND-82-0240C; CONF-82051-2) Avail. NTIS HC A02/MF A01

The United States is going to have to depend on an increasing mix of energy recovery and conversion processes, and they all have problems. These problems are discussed from the perspective of a national laboratory which has had the opportunity to conduct research and development on many of the options. Energy options discussed are: energy conservation, liquid fuels and how to acquire the needed supply (from kerogen, enhanced oil recovery, coal liquefaction), use of natural gas, geothermal energy sources, wind and solar energy, and nuclear power.

N83-22816# Stanford Univ., Calif. Inst. for Energy Studies
INTERNATIONAL ENERGY WORKSHOP, 1981

A. S. MANNE, ed. Jun 1982. 47 p. Workshop held at Stanford, Calif., 10-11 Dec 1981 (Contract DE-AT03-79PE-70117) (DE82-021183, CONF-811267-SUMM) Avail. NTIS HC A03/MF A01

Individual papers are synopsized with an overall assessment of the workshop. Poll results taken during the workshop are presented with tabulated data on real price of crude oil, real gross national product total primary energy consumption, domestic oil production, and oil imports for 1990 and 2000. A reference case is projected.

DOE

N83-22828# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
INVESTIGATION OF ATTIC INSULATION EFFECTIVENESS USING ACTUAL ENERGY CONSUMPTION DATA

T. F. SCANLAN, C. K. BAYNE, and D. R. JOHNSON. Sep 1982. 69 p. refs. (Contract W-7405-ENG-26) (DE83-000225, ORNL-5825) Avail. NTIS HC A04/MF A01

The effectiveness of attic installation was determined using actual energy consumption and weather data for 34 single family residences. For each residence, linear regression was used to determine the actual winter energy consumption rates for 2 years before and 3 years after the installation of attic insulation. Comparison of the pre- and post-installation energy consumption rates confirmed the effectiveness of attic insulation. Sufficient agreement between postinsulation predicted and actual consumption rates indicated that the insulation degradation factors has no gross effect and that estimates of heat loss through the ceiling based on the simple conductive heat loss model are adequate.

DOE

N83-22838# Commerce Dept., Washington, D.C. Office of Competitive Assessment
US ENERGY FOR THE REST OF THE CENTURY Annual Report, 1976-1982

J. F. GUSTAFERRO. 2 Jul 1982. 37 p. (PB83-114603) Avail. NTIS HC A03/MF A01. CSCL 10A

The basic quantitative results of recent U.S. Commerce Department forecasting efforts in the energy area are summarized.

The data cover the entire spectrum of U.S. energy requirements and focus on the end-use of energy for operational purposes, e.g., highway transportation, space heating, lighting, and road construction. The tables provide data on fuel consumption by types and Btu content for 1981 and as projected for the year 2000. Included also is a table indicating 47 components of industry's use of process heat and process steam.

GRA

N83-22846# Committee on Energy and Natural Resources (U.S. Senate).

ACID PRECIPITATION AND THE USE OF FOSSIL FUELS

Washington: GPO, 1982. 1546 p. refs. Hearing before the Comm. on Energy and Natural Resources, 97th Cong., 2d Sess., 10 Aug 1982 (GPO-98-172) Avail. Committee on Energy and Natural Resources

Acid precipitation and fossil fuel use in our national energy economy are reviewed.

Author

N83-22867# EG and G Automotive Research, Inc., San Antonio, Tex.

A STUDY OF EMISSIONS FROM LIGHT DUTY VEHICLES IN SAN ANTONIO, TEXAS, YEAR 2 Final Report, 29 Jul. 1981 - 29 Jul. 1982

M. FORSHEE and M. DALEN. 30 Jul 1982. 118 p. (Contract EPA-68-03-3024) (PB83-124743; EPA-460/3-82-009) Avail. NTIS HC A06/MF A01. CSCL 13F

Three hundred 1978 through 1982 in-use light duty vehicles were obtained from the public, in the San Antonio metropolitan area. These vehicles were tested as received for exhaust emissions utilizing the Federal test procedure, the highway fuel economy test, and four short mode tests. All vehicles were subjected to a thorough emissions control component inspection. Fifty vehicles which failed to meet applicable standards received maintenance and a retest.

Author (GRA)

N83-22962# Argonne National Lab., Ill.

BIOSTATISTICS AND HEALTH IMPACTS OF ENERGY TECHNOLOGIES

M. E. GINEVAN, B. A. CARNES, J. J. COLLINS, C. D. BROWN, J. R. B. CURTISS, N. DEVINE, and A. ROCK (Michigan Univ.) In: ANL Biol. and Med. Res. p. 73-76. Jun 1982. refs.

Avail. NTIS HC A08/MF A01

Statistical methodology and mathematical models relevant to the assessment of health impacts of energy technologies were developed. Efforts include: (1) development of a statistical procedure for reducing dimensionality in studies of disease environment association; (2) development of maximum eigenvalue least squares (MELS) theory for identifying, quantifying, and circumventing collinearity in regression models; (3) evaluation of statistical model violations in an analysis of covariance study of air pollution; and (4) development of an age period cohort model of breast cancer.

E. A. K.

N83-22977# Joint Publications Research Service, Arlington, Va.
PRESSING PROBLEMS OF RADIOECOLOGY IN LIGHT OF SOLVING ATOMIC ENERGY PROBLEMS

R. M. ALEKSAKHIN and G. G. POLIKARPOV. In: *its USSR Rept Life Sci. Biomed. and Behavioral Sci.*, no. 28 (JPRS-82696) p. 55-68. 21 Jan 1983. refs. Transl. into ENGLISH from Radiobiologiya (Moscow), v. 21, no. 1, Jan - Feb 1981. p. 97-108. Avail. NTIS HC A06/MF A01

The main tasks are outlined for modern radioecology in the area of migration of natural and artificial radionuclides, effects of ionizing radiation on natural biogeocenoses in connection with development of atomic energy. There is discussion of problems of setting ecological standards for radiation effects on ecosystems, and a classification is offered for natural zones according to criterion of radioecological condition. Emphasis is laid on the importance of studies of migration into the biosphere of radionuclides of the complete nuclear fuel turnover.

Author

SOLAR ENERGY

Includes solar collectors, solar cells, solar heating and cooling systems, and solar generators.

N83-23208# California Univ., Berkeley. Inst of Transportation Studies

RESEARCH IN TRANSPORTATION ENGINEERING IN THE UNITED STATES

C L MONISMITH /in CSIR Ann. Transportation Conv., Vol. 1 12 p 1982 refs
Avail NTIS HC A16/MF A01

Determinations for civil engineering research which are considered necessary in the United States are studied. Research needs were examined for societal needs such as shelter, food, air, water, conservation, transportation, energy and public safety. Critical transportation issues were identified as: transportation and energy relationships, transportation system performance and design, bridge design and construction, pavement management and rehabilitation, transport system maintenance, quality control and recycling of material, effective utilization of existing transportation systems, transportation safety, transportation financing, transportation of hazardous materials and the role of transportation during major emergencies. E.A.K.

N83-23212# Council for Scientific and Industrial Research, Pretoria (South Africa)

ANNUAL TRANSPORTATION CONVENTION, VOLUME 2. SESSION F: ENERGY AND TRANSPORTATION ENGINEERING. SESSION G: TRANSPORT PLANNING

1982 463 p refs Conv held in Pretoria, 9-13 Aug 1982 /in ENGLISH and AFRIKAANS 4 Vol
(CSIR-S-313-VOL-2, ISBN-0-7988-2507-3) Avail NTIS HC A20/MF A01

Issues regarding gasoline shortages, alternative fuels, and electric motor vehicles are discussed. Urban development and transportation planning methods are also considered.

N83-23245# Mellon Inst., Arlington, Va Energy Productivity Center

MAINTAINING AUTOMOTIVE MOBILITY: USING FUEL ECONOMY AND SYNTHETIC FUELS TO COMPETE WITH OPEC OIL Final Report

R H SHACKSON and H J LEACH 1 Mar 1982 101 p refs
(Contract DE-AC02-79CS-50108)
(DE83-004873; DOE/CS-50108/1) Avail NTIS HC A06/MF A01

The improvement of fuel economy and the production of nonpetroleum fuels which are criteria for implementation of cost reduction and reliability strategies over the next 20 years are compared. The study methodology has three major components: (1) an estimate of the costs of improving automobile and light truck fuel economy; (2) an estimate of the cost of producing synthetic fuels for transportation, and (3) subjecting these estimates to the scrutiny and criticism of a steering group composed of experts in the relevant fields. The methodology and data used to compute new automobile and light truck fuel economy, fleet fuel consumption, capital requirements, and consumer costs, under different scenario assumptions for the years 1980 to 2000 are described. The baseline technology fleet characteristics and the automotive technology are described. The effects of introducing new technologies into the car and truck fleet are examined based on several scenarios, followed by a sensitivity analysis. DOE

N83-23250# General Research Corp., Santa Barbara, Calif
SYNTHETIC FUELS FOR TRANSPORTATION. BACKGROUND PAPER 1: THE FUTURE POTENTIAL OF ELECTRIC AND HYBRID VEHICLES

W M CARRIERE, W F HAMILTON, and L M MORECRAFT
Mar. 1982 236 p refs
(PB83-126086; OTA-BP-E-13, LC-82-600500) Avail: NTIS HC A11/MF A01 CSCL 13F

A comprehensive review of the future of electric and hybrid vehicles through the year 2010 in the United States was presented. It discussed the technology, performance, and limitations of probable future electric and hybrid vehicles, the infrastructure necessary to produce and support them, marketability, and and finally, effects on the nation if used in large numbers. GRA

A83-19885

ELECTROCHEMICAL SOLAR CELLS USING CDSE THIN FILM ELECTRODES

X-R XIAO (Michigan State University, East Lansing, MI, Academia Sinica, Beijing, People's Republic of China) and H. T. TIEN (Michigan State University, East Lansing, MI) Electrochemical Society, Journal, vol. 130, Jan 1983, p. 55-59 refs
(Contract DE-FG02-80CS-83101)

Electrochemical photocells consisting of a CdSe thin film anode and a Pt cathode immersed in 1M Na2S-NaOH-S solution have been studied. CdSe thin films were formed on Ti, Cr, Mo, SnO2, glassy carbon, and graphite substrates by coating an aqueous mixture of CdSe, ZnCl2, and surfactant, subsequently sintering at 400-500 deg C in air. The current-voltage (I-V) relations, output power efficiency, open-circuit voltage, and short-circuit current were measured. 7% power conversion efficiency was obtained at 20 mW/square cm light intensity after photoetching. The monochromatic I-V curves were analyzed. (Author)

A83-19893

PRACTICAL LIMITING EFFICIENCIES FOR CRYSTALLINE SILICON SOLAR CELLS

J A. AMICK and A K GHOSH (Exxon Research and Engineering Co., Linden, NJ) Electrochemical Society, Journal, vol. 130, Jan 1983, p. 160-164 refs

A review is given of the factors governing the conversion efficiency for crystalline silicon solar cells at AM1 and of the practical limits on cell efficiencies. Included are losses due to reflection, shadowing, carrier diffusion length and (I-squared)(R) dissipation. The influence of polycrystalline grain size on conversion efficiency is also discussed. For conventional cells having a planar junction, a practical limiting efficiency in production appears to be about 17% in the absence of sunlight concentration. (Author)

A83-19991

ORIGIN OF THE DIFFERENCE IN THE OPEN CIRCUIT VOLTAGE BETWEEN P-I-N TYPE AND N-I-P TYPE HYDROGENATED AMORPHOUS SILICON SOLAR CELLS

I SAKATA and Y. HAYASHI (Ministry of International Trade and Industry, Sakura, Ibaraki, Japan) Applied Physics Letters, vol. 42, Feb 1, 1983, p. 279-281 refs

A83-20136

F-CHART METHOD APPLIED TO LARGE-SCALE SOLAR COLLECTOR SYSTEMS SUBJECT TO A SHADOW EFFECT OF ADJACENT COLLECTORS

M SCHROEDER (Vereinigte Deutsche Metallwerke AG, Frankfurt am Main, West Germany) International Journal of Solar Energy, vol. 1, no. 3, 1982, p. 169-184 refs

A83-20137

SUNSHINE PROJECT SOLAR PHOTOVOLTAIC PROGRAM AND RECENT ACTIVITIES IN JAPAN

M KAMIMOTO and H HAYASHI (Ministry of International Trade and Industry, Tokyo, Japan) International Journal of Solar Energy, vol. 1, no. 3, 1982, p. 185-195

A83-20139

THE SIMULATION OF GLOBAL RADIATION (ZUR SIMULATION DER GLOBALSTRAHLUNG)

J KROCHMANN (Berlin, Technische Universität, Berlin, West Germany) International Journal of Solar Energy, vol. 1, no. 3, 1982, p. 223-236 In German refs

Devices for the utilization of solar energy should have a high operational efficiency. It is, therefore, important to conduct

02 SOLAR ENERGY

representative tests. Tests of solar devices are performed either outdoors under usually undefined solar radiation conditions or indoors. In connection with a testing indoors, use is made of facilities which provide a simulated global radiation under defined experimental conditions. The considered facilities are also employed to study the effect of solar radiation on electrical and other structural elements. Facilities for the simulation of global radiation are to satisfy certain conditions with respect to radiation intensity, the angle of radiation incidence, and the relative spectral energy distribution of the radiation. Difficulties are related to the achievement of a relative spectral energy distribution which corresponds exactly to the energy distribution in the global radiation. The examination of silicon solar cells in simulation facilities using xenon lamps is discussed. G R.

A83-20435

STATUS OF PHOTOVOLTAIC MATERIALS AND PROCESS TECHNOLOGIES

S. K. DEB (Solar Energy Research Institute, Golden, CO) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p 92-103 refs

The current status of photovoltaic materials and process development technologies are reviewed. A number of advanced materials such as single crystal and polycrystalline silicon, amorphous silicon, CdS/Cu₂S and CdS/CuInSe₂, GaAs and several promising new materials like CdTe, Zn₃P₂, InP, and Cu₂Se are discussed in some detail. Several process technologies involving growth of low-cost single crystal and polycrystalline silicon, as well as fabrication of thin-film solar cells, are reviewed.

(Author)

A83-20580

PHOTOELECTROLYSIS OF WATER UNDER VISIBLE LIGHT WITH DOPED SrTiO₃ ELECTRODES

M. MATSUMURA, M. HIRAMOTO, and H. TSUBOMURA (Osaka University, Toyonaka, Japan) Electrochemical Society, Journal, vol 130, Feb. 1983, p 326-330 refs

The photochemical behavior of strontium titanate (SrTiO₃) sintered electrodes doped with various metal oxides is reported, with reference to the development of semiconductor electrodes applicable in solar energy conversion. The doped semiconductor electrodes were synthesized from 99.9% pure SrTiO₃ powder mixed with reagent grade metal oxide which was then pressed into disks of 1 cm in diameter and sintered at 400 C for 2 hr. From the I-V and other characteristic curves which were plotted for various wavelengths, the energy level of the surface state of SrTiO₃ electrode is estimated to lie at 1.9 eV below the conduction band. The SrTiO₃ electrodes doped with RuO₂, V₂O₅, Cr₂O₃, Ce₂O₃, CoO, and Rh₂O₃ showed photoresponse in visible light, while undoped SrTiO₃ and those electrodes doped with other metal oxides such as ZnO and Al₂O₃ were photosensitive only in UV light. The electroluminescence spectra of the doped electrodes are classified into three groups: those that have electroluminescence characteristics similar to those of the undoped electrodes, those with very intense and narrow luminescence bands in the visible region, and those that exhibit a broad band at wavelengths shorter than those of the undoped electrodes. M.I.I.

A83-20581

PHOTOELECTROCHEMICAL PROCESSES IN BISMUTH GERMANIUM OXIDE, Bi₁₂GeO₂₀ SINGLE CRYSTALS

K. KOCHIEV, K. TSVETKOVA, and M. GOSPODINOV (B'lgarska Akademiia na Naukite, Tsentralna Laboratoriia po Sl'nceva Energiia i Novi Energini Iztochnitsi and Institut po Fizika na Tv'rdoto Tialo, Sofia, Bulgaria) Electrochemical Society, Journal, vol 130, Feb. 1983, p 330-332 refs

The photoelectrochemical properties of bismuth germanium oxide (BGO) single crystals are studied. The crystals were grown by the Czochralski method from a Bi₂O₃ and GeO₂ melt, and semiconductor samples were cut perpendicular to the growth axis, and subsequently polished, treated in concentrated HCl and then

reduced in a hydrogen atmosphere at 500-600 C for 1 hr. The semiconductor electrode was illuminated with an illumination intensity of about 200 mW/sq cm, and electrochemical measurements were made in a two compartment cell containing a 5 N NaOH electrolyte and with a saturated calomel electrode as the reference electrode. It is observed from the obtained I-V curve that the reduced BGO wafers have n-type semiconductor properties, while the unreduced samples have negligible anodic and cathodic currents and exhibited no photosensitivity. Photosensitivity up to 0.5 micron in the range of 400-500 nm was observed and a flatband potential of about -0.68 V vs. SCE was determined. It is assumed that oxygen vacancies were created during the reduction process, and the fact that a thermal treatment for a short time in an oxygen atmosphere restores the original electrical and optical properties of the semiconductor supports this assumption. The flatband potential of -0.68 V suggests that photoelectrolysis cannot be possible without an external energy source, but it is noted that the use of this semiconductor with an appropriate redox system in self-generating solar cells is possible. M.I.I.

A83-20594

CHEMICAL BATH DEPOSITION OF THIN FILM CADMIUM SELENIDE FOR PHOTOELECTROCHEMICAL CELLS

R. A. BOUDREAU and R. D. RAUH (EIC Laboratories, Inc., Newton, MA) (Electrochemical Society, Meeting, Denver, CO, Oct. 11-16, 1981.) Electrochemical Society, Journal, vol 130, Feb 1983, p 513-516. Research supported by the U.S. Department of Energy. refs

Chemical bath deposition provides an attractive, low cost method of producing cadmium chalcogenide thin films. Intimate contact between the bath solution and the substrate material permits uniform deposition on substrates of complex geometry, presently difficult with spray pyrolysis, vacuum evaporation, or electrodeposition techniques. For CdSe, rigorous control of deposition conditions promotes the formation of a hexagonal, specularly reflecting deposit rather than a less desirable sphalerite (cubic) powdery deposit. Scanning electron microscopy reveals a small grained layered plate morphology similar to that produced by the evaporation method. Specularly reflecting CdSe films can be formed over large area substrates at a thickness optimal for their use as photoelectrochemical cells (PEC). Employing polysulfide as the redox couple, conversion efficiencies as high as 6.8% have been achieved in our laboratory for these films using a tungsten-halogen white light source. (Author)

A83-20751

AN OPTIMIZATION OF MONOLITHIC PHOTOVOLTAIC SERIES ARRAYS

E. M. MURRAY (Hewlett-Packard Laboratories, Palo Alto, CA) and R. M. WARNER, JR (Minnesota, University, Minneapolis, MN) Journal of Applied Physics, vol. 54, Jan. 1983, p 410-414. refs

An analytical treatment is given to the design parameters of a monolithic, series-array solar cell. Use of a monolithic configuration is attractive because it minimizes the joining of dissimilar materials, although the danger exists that nonuniformity in construction or unequal illumination will create a situation in which a lowered output in one cell will lower the output of the entire array. A numerical model is developed for the number of cells required to maximize the output for a given semiconductor area. A striped geometry is investigated, considering only square cells. Account is taken of a front grid contact and shunting diodes, interconnect losses, area shading by the grid fingers, and the area for the shunting diodes. A trade-off is found to be necessary between the output and active area losses. Optimization is noted to be individualized for a given array. M S K

A83-20959

AN IMPROVED PORTABLE THERMORADIOMETER /TRM/ FOR MEASURING THE RELATIVE EMISSIVITY OF SOLIDS AT ROOM TEMPERATURE [USOVERSHENSTVOVANNYI PORTATIVNYI TERMORADIOMETR TRM DLIA IZMERENII OTNOSITEL'NOI IZLUCHATEL'NOI SPOSOBNOSTI TVERDYKH TEL PRI KOMNATNOI TEMPERATURE]

V L SHIPUNOV, S A DEMIDOV, S F NAUMOV, N I POTAPOV, I U M NIKULIN, and V V IVANOV (Nauchno-Proizvodstvennoe Ob'edinenie Energii, Moscow, USSR) Promyshlennaya Teplotekhnika, vol 5, Jan-Feb 1983, p 55-58 In Russian

The design and operating principle of a new portable radiometer for measuring the emissivity of solids at room temperature are briefly discussed. The instrument is designed for indoor measurements in the temperature range 10-35 C, at relative humidities up to 60%, and is accurate to within 0.015. The radiometer can be used for measuring the relative emissivity (blackness) of the radiating surfaces of various solar-power devices and thermal-power plants V L

A83-21066

SOLAR POWER APPLICATIONS - ALCOHOLS

T. N VEZIROGLU (Miami, University, Coral Gables, FL) In Alternative energy sources IV Volume 3 - Solar power applications - Alcohols Ann Arbor, MI, Ann Arbor Science Publishers, 1982, p 95-102 refs

Fully synthetic organic photovoltaic vesicles were manufactured and tested for output efficiency and shelf life of the constituents. Thermal copolyamine acids were placed in water and then heated or exposed to ultrasonic waves and allowed to cool. Uniform proteinoid microspheres (vesicles) formed, and were pierced with microprobes. Illumination of the cells caused a change in the potential across the cell membranes. It was found that the polarization potential across the membrane was dependent on the potassium concentration in the cells and the pH of the medium. Cells with chlorophyll yielded 0.850 V, while phthalocyanine cells produced 0.350 V. Enhancement of the quantum efficiency of the cells by fractionation of the constituents of the cells is suggested, noting that a merocyanine dye Schottky barrier cell has been manufactured and has displayed a 0.7% sunlight conversion efficiency. Further studies on the combination of the artificially-produced cells into a tissue is indicated M S K.

A83-21627

AMORPHOUS SILICON - A NEW SEMICONDUCTOR MATERIAL FOR SOLAR CELLS [AMORPHES SILIZIUM - EIN NEUES HALBLEITERMATERIAL FUER SOLARZELLEN]

W HEYWANG and R D PLAETTNER (Siemens AG, Forschungslaboratorien, Munich, West Germany) Metall, vol. 37, Jan 1983, p. 49-55. In German refs

The structure, function, manufacture, and properties of amorphous silicon solar cells are reported on. The generation of electrons and holes in the cells, the relationship between the energy gap and the maximum theoretical efficiency, and the comparative absorption characteristics are discussed. The layered structure of various types of silicon solar cells are described, and the process of their fabrication is addressed. The parameters of efficiency are considered, showing the volt-ampere characteristics of a cell with pin-ITO structure. Developmental trends are discussed C D

A83-22275

SOLAR RECEIVER CAVITY INSULATION EVALUATION

D BARTLETT, B KNOTSON, R ZENTNER (Boeing Engineering and Construction Co., Seattle, WA), and J BIGGER (Electric Power Research Institute, Palo Alto, CA) Ceramic Engineering and Science Proceedings, vol 3, Sept-Oct 1982, p 810-819

Due to failure of material used as high temperature insulation in the Boeing/EPRI 1 MW (thermal) Bench Model Solar Receiver (BMSR), a three-phase program was initiated to evaluate insulation materials and design concepts which would survive long periods of exposure. The three phases of the program included (1) the development of alternate cavity-insulation concepts, (2) screening

the concepts using a Xe arc-lamp solar-simulation facility, and (3) solar testing of the selected concept at the Advanced Components Test Facility at the Georgia Institute of Technology (Author)

A83-22337

PHOTOCONDUCTIVITY AND PHOTOVOLTAIC EFFECT IN INDIUM SELENIDE

A SEGURA (Valencia, Universidad, Burjassot, Spain), J. P GUESDON, J. M BESSON, and A CHEVY (Paris VI, Université, Paris, France) Journal of Applied Physics, vol 54, Feb. 1983, p. 876-888 refs

Transport and phototransport properties of crystalline indium monoselenide (InSe) doped with a variety of elements are reported. Measured mobilities, lifetimes, and effective diffusion lengths of photoexcited carriers are used to interpret electrical and photovoltaic properties of several different structures. These include p-n junctions, bismuth/p-type InSe, platinum/n-type InSe, and indium tin oxide/p-type InSe. External solar efficiencies of the best devices are between five percent and six percent. The influence on the efficiency of the various parameters is evaluated, and ways of improvement are discussed (Author)

A83-22617#

SOLAR ALTITUDE FREQUENCY TABLES

R S MCDOWELL (Los Alamos National Laboratory, Los Alamos, NM) Applied Optics, vol 22, Feb 15, 1983, p 563-567. Research supported by the U.S. Department of Energy refs

A table is presented that gives the total number of hours in the year during which the sun's altitude exceeds a given value h , for $h = 0.88$ deg in 2 deg increments and for latitudes from the Equator to the North Pole in 2 deg increments. The table also gives corrections to these figures for the effect of atmospheric refraction and the total hours of daylight at each latitude.

(Author)

A83-22618

AREA UTILIZATION EFFICIENCY OF A SLOPING HELIOSTAT SYSTEM FOR SOLAR CONCENTRATION

L Y WEI (Waterloo, University, Waterloo, Ontario, Canada) Applied Optics, vol 22, Feb 15, 1983, p 568-572 refs

Area utilization efficiency (AUE) is formulated for a sloping heliostat system facing any direction. The effects of slope shading, incidence factor, sun shading, and tower blocking by the mirrors are all taken into account. The results show that annually averaged AUEs calculated for heliostat systems (1) increase with tower height at low slope angles but less rapidly at high slopes, (2) increase monotonically with slope angle and saturate at large slopes for systems facing due south, (3) reach a maximum at a certain slope for systems facing other directions than due south, and (4) drop sharply at slopes greater than a certain value for systems facing due east or west due to slope shading effect. The results are useful for solar energy collection on non-flat terrains (Author)

A83-22619

LIGHT TRANSPORT IN PLANAR LUMINESCENT SOLAR CONCENTRATORS - THE ROLE OF DCM SELF-ABSORPTION

J SANSREGRET, J M DRAKE, W R L THOMAS (Exxon Research and Engineering Co., Linden, NJ), and M L LESIECKI (Universidad de Puerto Rico, Rio Piedras, PR) Applied Optics, vol. 22, Feb 15, 1983, p 573-577 refs

The influence of self-absorption in a 4-dicyano-methylene-2-methyl-6-p-dimethyl amino-styryl-4H-pyran (DCM) doped polymethylmethacrylate optical waveguide on the light transport efficiency has been evaluated. A Monte Carlo technique was used to simulate intermolecular energy transfer and calculate the energy emission profile of an active waveguide. The calculated and measured edge emission profiles were found to be in excellent agreement. The edge emission spectra for various distances of excitation from the edge were used to estimate the DCM self-absorption cross section. (Author)

02 SOLAR ENERGY

A83-22620

EFFECT OF ARGON PRESSURE ON THE OPTICAL PROPERTIES OF SPUTTERED SOLAR SELECTIVE SURFACES
S. CRAIG and G. L. HARDING (Sydney, University, Sydney, Australia) Applied Optics, vol 22, Feb. 15, 1983, p. 583-586. refs

The influence of argon gas pressure (0.15-40 Pa) on the refractive indices n, k of dc planar-magnetron reactively sputtered cermet and amorphous semiconductor films has been investigated for a layer thickness of about 50 nm. Stainless steel-carbon and amorphous hydrogenated carbon layers with relatively low index n and stainless steel-silicon and amorphous hydrogenated silicon layers with relatively high index n are examined with a view to solar selective surface applications. The development of structural porosity with associated reduction in n for layers deposited at high argon pressure significantly improves the solar absorptance of surfaces incorporating stainless steel-silicon or amorphous hydrogenated silicon layers. (Author)

A83-22903

AL-SI PEAKED SCHOTTKY BARRIERS

G. P. SRIVASTAVA, K. K. SHARMA, P. K. BHATNAGAR, V. N. OJHA (Delhi, University, Delhi, India), and S. R. DHARIWAL (Government College, Ajmer, India) Solar Cells, vol. 7, Dec. 1982, p. 209-218. refs

A theoretical model for the Al-SiO₂-n-Si peaked Schottky barrier is proposed in which an ultrathin oxide layer was introduced between heavily doped fully ionized p(+) and n(+) regions. The potential distribution was obtained by solving the Poisson equation. The capacitance-voltage and current-voltage characteristics obtained showed good agreement with the experimental results of earlier workers. (Author)

A83-22905

PHOTOELECTROCHEMICAL BEHAVIOUR OF ELECTRODEPOSITED AND PRESSURE-SINTERED BI₂S₃, BI₂S₃-PBS AND BI₂S₃-AG₂S SEMICONDUCTOR ELECTRODES

P. K. MAHAPATRA and C. B. ROY (Indian Institute of Technology, Kharagpur, India) Solar Cells, vol. 7, Dec 1982, p. 225-232. refs

A83-22907

EXPERIMENTAL AND THEORETICAL STUDIES OF CU₂O SOLAR CELLS

L. C. OLSEN, F. W. ADDIS, and W. MILLER (Joint Center for Graduate Study, Richland, WA) Solar Cells, vol 7, Dec. 1982, p. 247-279. Research supported by the U.S. Department of Energy and NSF. refs

Research on the fabrication of Cu₂O solar cells is described, with an emphasis on techniques for low-cost production. Cu₂O has been investigated due to the low cost of the materials, their abundance, projected high efficiencies in solar cell use, (22%) and the simplicity of production of thin layers. It has been found that a homojunction is necessary in order to obtain low values of the reverse saturation current density. Production of the cells through oxidation of high purity copper disks has been demonstrated, together with p-type resistivities of about 10-100 ohm-cm when a low partial pressure of chlorine is provided during oxidation. A practical photo-current density of 12-14 mA/sq cm has been projected, and a cell with 176% efficiency has been realized. Finally, electrooptical and thermodynamic examinations of Schottky barrier Cu₂O cells are summarized, noting that only gold, silver, and thallium will not reduce Cu₂O, and that only thallium can be combined with Cu₂O without forming an ohmic contact. M.S.K.

A83-22908

EFFECT OF GRAIN BOUNDARIES ON THE MINORITY CARRIER DIFFUSION LENGTH IN INP SOLAR CELLS

L. TARRICONE (CNR, Gruppo Nazionale di Struttura della Materia, Parma, Italy), E. DON, N. M. PEARSALL, and J. T. COUTTS (Newcastle-upon-Tyne Polytechnic, Newcastle-upon-Tyne, England) Solar Cells, vol 7, Dec. 1982, p. 281-290. Research supported by the Foundation A. della Riccia. refs

A minority carrier diffusion length inhomogeneity induced by grain boundaries on indium tin oxide/CdS/InP and indium tin oxide/InP polycrystalline solar cells has been investigated. The open-circuit voltage method has been employed and scanning surface photovoltage measurements have been carried out. By illuminating selected areas of the devices with a light of low intensity whose energy was varied in a narrow spectral range above the energy band gap of InP, a decrease in the diffusion length corresponding to the grain boundary position was detected. An explanation of the limited conversion efficiency achieved in these solar cells has been partially ascribed to the presence of a high grain boundary interface states density within high angle grain boundaries. (Author)

A83-22909

EFFECT OF AN SiC LAYER ON P-I-N AMORPHOUS SILICON SOLAR CELLS

D. HANEMAN and R. LUJAN (Xerox Palo Alto Research Center, Palo Alto, CA) Solar Cells, vol. 7, Dec. 1982, p. 291-295. refs (Contract XJ-0-9079)

Solar p-i-n junction cells were fabricated on indium-tin-oxide-coated glass and parameters and lifetime were tested for p layers made both of hydrogenated amorphous silicon and of admixtures of SiC. The hydrogenated amorphous silicon cells gave efficiencies of around 6% but the cells with admixtures of SiC showed around 5 1/4% efficiency, although they gave about 20% higher short-circuit current. The cell lifetime behavior was very similar, suggesting that the dominant factors, as yet unidentified, in determining lifetime were in the i layer. (Author)

A83-22910

A MODEL FOR THE COLLECTION OF MINORITY CARRIERS GENERATED IN THE DEPLETION REGION OF A SCHOTTKY BARRIER SOLAR CELL

R. J. SOUKUP and D. R. SLOCUM (Nebraska, University, Lincoln, NE) Solar Cells, vol. 7, Dec 1982, p. 297-310. refs

A83-22911

EA STUDY OF SOLAR CONCENTRATOR PANELS WITH FLUORESCENT COMPOUNDS [ETUDE DE PANNEAUX SOLAIRES CONCENTRATEURS A PRODUITS FLUORESCENTS]

H. BLUMENFELD, M. BOURDINAUD, and G. GIBON (Commissariat a l'Energie Atomique, Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette, Essonne, France) Solar Cells, vol. 7, Dec 1982, p. 311-325. In French. Research supported by the Commissariat a l'Energie Solaire refs

Experimental results from the determination of the excitation and emission spectra, as well as the long-term stability, of luminescent dyes for concentrator photovoltaic panels are presented. The substances investigated were organic dyes immersed in polymethacrylate, organic dyes dissolved in water, methanol, ethanol, and propanol-2, and luminescent inorganic ions imbedded in various glasses. The study was spurred by the desire to capture both diffuse and direct solar radiation, and to reduce the cost of solar cell panels by the higher energy efficiencies and the elimination of tracking mechanisms. The panels examined included a cascade configuration of three panels, with the final emission tailored to the absorption range of the cells. A second apparatus consisted of a cascade of fluorescent panels which changed the emission spectra at each step until the final panel emitted radiation compatible with the solar cell. The methacrylate fluorescent panel gave the best performance, multiplying the output by a factor of two, although the dyes exhibited a short lifetime.

and degenerated in exponential relation to the intensity of the irradiance
M.S.K.

A83-22912

A SEMICONDUCTOR-INSULATOR-SEMICONDUCTOR CDO-SIO2-SI SOLAR CELL

I SHIH, S JATAR, C H CHAMPNESS (McGill University, Montreal, Canada), and N LIRIA (Institut National des Sciences Appliquees, Toulouse, France) Solar Cells, vol 7, Dec 1982, p. 327-330 Research supported by the Natural Sciences and Engineering Research Council of Canada. refs

A semiconductor-insulator-semiconductor photovoltaic structure of the form CdO-SiO₂-Si has been fabricated by reactively sputtering a layer of n-type CdO on a thin SiO₂ layer thermally grown on a p-type silicon substrate. The photovoltaic characteristics of the best cell under approximate air mass (AM) 1 illumination show an open-circuit voltage of 0.46 V and a short-circuit current density of 30 mA/sq cm, giving a conversion efficiency of about 7 percent. The spectral response of the device extends from 0.4 to 1.1 micron (Author)

A83-22913

HIGH EFFICIENCY P+/+N-N/+/- BACK-SURFACE FIELD SILICON SOLAR CELLS WITH VERY LARGE SHORT-CIRCUIT CURRENT DENSITIES

J NIJS, J VAN MEERBERGEN, F DHOORE, R MERTENS, and R. VAN OVERSTRAETEN (Leuven, Katholieke Universiteit, Louvain, Belgium) Solar Cells, vol 7, Dec 1982, p. 331-336 Research supported by the Fonds National de la Recherche Scientifique, European Economic Community refs (Contract EEC-153-77-9-ESB)

A technological process for the production of p(+)-n-n(+) silicon solar cells with efficiencies of 17% and total area short-circuit current densities of 36 mA/sq cm at air mass 1 conditions is described. The results were obtained with non-texturized surfaces and a single antireflection coating. The reasons for the high short-circuit current densities are described. (Author)

A83-22914

ACCURACY OF ANALYTICAL EXPRESSIONS FOR SOLAR CELL FILL FACTORS

M. A. GREEN (New South Wales, University, Kensington, Australia) Solar Cells, vol 7, Dec 1982, p. 337-340

A comparative study is made of the accuracy of different expressions of the fill factor (FF) of a solar cell, and new expressions which might be of use for specific accuracy requirements are described. A summary of the new expressions is given along with their accuracy and ranges of validity. The effects of ideality factor, temperature, and series and shunt parasitic resistances on the FF are discussed. M I I

A83-22915

AMORPHOUS SILICON BIBLIOGRAPHY UPDATE - INTRODUCTION

A H MAHAN and J L STONE (Solar Energy Research Institute, Golden, CO) Solar Cells, vol 7, Jan 1983, p. 347-403, 405-425 refs

A83-22924* Jet Propulsion Lab., California Inst of Tech., Pasadena

MINIMUM SILICON WAFER THICKNESS FOR ID WAFERING

C P CHEN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) Electrochemical Society, Journal, vol 129, Dec 1982, p. 2835-2837 refs

An analytical model, based on fracture mechanics analysis, is proposed for estimating the minimum wafer thickness as a function of the diameter requirement for solar cells. The conditions under which the model can be applied are discussed with reference to the critical flaw size, the applied force, and the width of the side support. It is shown that the equivalent cantilever force applied during ID slicing can be estimated from the wafering mechanical yield data. The width of the wafer side support was found to be a

significant factor in controlling the minimum allowable wafer thickness during slicing. Wafer side support width requirements were found to increase with decreasing wafer thickness. M I I

A83-23127#

A METHOD OF EVALUATING AND SIZING SOLAR COGENERATION SYSTEMS

J. T. ATOR (Aerospace Corp., Energy and Resources Div., El Segundo, CA) Journal of Energy, vol. 7, Mar-Apr. 1983, p. 99, 100

(Previously cited in issue 03, p. 398, Accession no A82-14014)

A83-23129#

TRANSIENT ANALYSIS OF A NATURAL CIRCULATION SOLAR WATER HEATER WITH A HEAT EXCHANGER

M S SODHA, G. N. TIWARI (Indian Institute of Technology, New Delhi, India), and S N SHUKLA Journal of Energy, vol. 7, Mar-Apr. 1983, p. 107-111 Research supported by the Ministry of Industrial Development. refs

This paper presents a transient analysis of the performance of a solar water heating system with natural circulation of hot water between the collector and the insulated storage tank. Provision for hot water delivery for domestic/industrial uses has been made through a heat exchanger placed in the storage tank. Explicit expressions for the mean system and water delivery temperature obtained in this paper are simpler and more straightforward than those obtained numerically by Tzafestas et al., (1974) using a finite difference method, who also define an artificial heat transfer coefficient. This paper further investigates the effect of the exchanger length on the performance of the system and may help a designer to properly size the heat exchanger. Numerical calculations have been made for a typical cold day (Jan 26, 1980) at Delhi for two modes of hot water withdrawal, viz., the constant flow-rate mode and the constant water delivery temperature mode (Author)

A83-23137*# Jet Propulsion Lab., California Inst of Tech., Pasadena

CONFIGURATION SELECTION STUDY FOR ISOLATED LOADS

W REVERE, J BOWYER, T FUJITA, and H AWAYA (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) Journal of Energy, vol 7, Mar-Apr. 1983, p. 160-167 Research sponsored by the U S Department of Energy and NASA refs

(Previously cited in issue 06, p. 900, Accession no A82-18223)

A83-23164

ON THE ORIENTATION PRECISION OF SATELLITE SOLAR POWER STATIONS [K VOPROSU O TOCHNOSTI ORIENTIROVANIJA KOSMICHESKIKH SOLNECHNYKH ELEKTROSTANTSII]

N A. ARMAND, A N LOMAKIN, and B M PARAMONOV Radiotekhnika i Elektronika, vol 28, Jan 1983, p. 157-163 In Russian. refs

Attention is given to various factors which determine the orientation precision of satellite solar power stations and can lead to additional losses during the microwave energy transmission. These factors include absorption and scattering in the atmosphere, the imprecision in the establishment of the amplitude-phase distribution on the transmitting antenna, and frequency instability. A new scheme for the interferometric monitoring of orientation precision is proposed, and the necessary length of the interferometer baseline is determined. B J

02 SOLAR ENERGY

A83-23212

NUMERICAL CALCULATION OF THE HEAT TRANSFER BY NATURAL CONVECTION IN A CUBICAL ENCLOSURE

S. J. M. LINTHORST and C. J. HOOGENDOORN (Delft, Technische Hogeschool, Delft, Netherlands) In: Numerical methods in laminar and turbulent flow; Proceedings of the Second International Conference, Venice, Italy, July 13-16, 1981. Swansea, Wales, Pineridge Press, 1981, p. 1069-1078 refs

Numerical calculations of the heat transfer by natural convection in a cubical box are described. Two vertical opposing walls are supposed isothermal. All sidewalls are assumed to be adiabatic or perfectly conducting. The Rayleigh range considered varied between 10,000 and 1,000,000. Air was taken as the working fluid and the flow was considered to be three-dimensional, laminar and stationary. Solutions of the governing equations are obtained with a method of finite differences using a nonlinear grid. A method is used to correct the results for the influence of the grid used in the numerical calculation by varying the nonlinearity parameter. Application of this more accurate method showed the value of the calculated Nusselt number to be smaller than the value obtained without the correction for the grid. (Author)

A83-23219

FINITE ELEMENT ANALYSIS OF MIXED CONVECTION APPLIED TO THE STORAGE OF SOLAR ENERGY

D. AUBRY (Ecole Centrale des Arts et Manufactures, Chatenay-Malabry, Hauts-de-Seine, France) and D. ZANDVLIET (Centre Scientifique des Techniques du Batiment, Paris, France) In: Numerical methods in laminar and turbulent flow, Proceedings of the Second International Conference, Venice, Italy, July 13-16, 1981. Swansea, Wales, Pineridge Press, 1981, p. 1241-1252 refs

Numerical computations are carried out for the transient mixed convection in a fluid, the Navier-Stokes equations are coupled with the equation of conservation of energy because the density is dependent on the temperature. The finite-element method is used for space discretization, and the incompressibility condition is approximately satisfied by using a penalization technique together with selective reduced integration. The two-step method proposed by Zlamal (1977) is used for time discretization. Finally, the approach adopted here is applied to transient flow of a fluid inside a solar-energy storage tank. V.L.

A83-23333#

TRANSIENT CHARACTERISTICS OF FLAT-PLATE SOLAR COLLECTOR

A. SAITO, Y. UTAKE, K. KATAYAMA (Tokyo Institute of Technology, Tokyo, Japan), and T. TSUCHIO (Nissin Seiko Co., Ltd., Japan) JSME, Bulletin, vol 26, Jan 1983, p. 79-86 refs

An analytical study of the transient performance of flat plate solar collectors for air conditioning and hot water supply during periods of solar intensity fluctuations is presented. The outlet water temperature was characterized in terms of the insolation fluctuations. A physical model is developed for the entire systems, with differential equations describing the heat balance at points along the fluid flow path. Predictions made with the model were compared with the measured performance of a flat plate collector system in the laboratory using an IR lamp for simulating the unsteady solar input. Acceptable agreement was found between predictions and data, and eleven nondimensional parameters which affect the outlet water temperature were identified. Further work is indicated to produce a generalized equation for performance in varying insolation. M.S.K.

A83-23665

INFLUENCE OF DIFFUSION OF HOT CARRIERS ON COLLECTION EFFICIENCY OF SOLAR CELLS - A-Si:H

A. BHATTACHARYYA (Signetics Corp., Philips Research Laboratories, Sunnyvale, CA) Journal of Physics D - Applied Physics, vol. 16, Feb. 14, 1983, p. 181-184. refs

A83-23859

PROGRESS IN PHOTOVOLTAIC ENERGY CONVERSION

R. VAN OVERSTRAETEN, J. NIJS (Leuven, Katholieke Universiteit, Heverlee, Belgium), and R. MERTENS (Leuven, Katholieke Universiteit, Heverlee; Fonds National de la Recherche Scientifique, Brussels, Belgium) Reports on Progress in Physics, vol 45, Oct. 1982, p. 1041-1111. refs

The actual status of research on photovoltaic energy conversion with regard to its possible role in the production of electric power from solar radiation is reviewed. Silicon cells in single-crystalline or semi-crystalline forms are considered to be the dominant devices for the next decade. A variety of possibilities yielding lower fabrication costs and still high conversion efficiencies exist; an order-of-magnitude reduction from the present-day cost level turns out to be a realistic goal. This can be achieved by a combined effort in the fields of silicon material preparation, cell processing and module fabrication. Other longer term viable options are amorphous silicon, thin-film GaAs, II-VI compounds such as CdS and some advanced approaches using concentrated sunlight. It is believed that ultimately module efficiency will strongly determine the economic viability of a photovoltaic material. (Author)

A83-23880#

F-CHART - PREDICTIONS AND MEASUREMENTS

J. A. DUFFIE and J. W. MITCHELL (Wisconsin, University, Madison, WI) ASME, Transactions, Journal of Solar Energy Engineering, vol. 105, Feb 1983, p. 3-9. refs

The level of accuracy of the f-chart method of predicting the annual performance of a solar heating system is tested against performance measurements, with consideration given to an enlarged initial data base. Implicit in the f-chart method are assumptions that the storage tank contains thoroughly mixed fluid and that heat can be delivered to load as long as the tank water is 20 C higher than the room temperature. Both liquid and air systems are considered, and month-by-month estimates of the solar contribution to heating and cooling loads are calculated. Comparisons of predictions with performance were made for a liquid system with liquid heat storage, an air system with pebble bed storage, and a hot water only system, using data from nine U.S. system installation sites. Generally good agreement was found, although a tendency was revealed to underestimate the performance of air systems when using the f-chart method. The f-chart is concluded to be valid for the systems for which it was designed, and only within the ranges of design parameters. M.S.K.

A83-23881#

CONVECTIVE LOSSES FROM CAVITY SOLAR RECEIVERS - COMPARISONS BETWEEN ANALYTICAL PREDICTIONS AND EXPERIMENTAL RESULTS

A. M. CLAUSING (Illinois, University, Urbana, IL) ASME, Transactions, Journal of Solar Energy Engineering, vol. 105, Feb 1983, p. 29-33. refs

A83-23882#

OPTIMAL CONTROL OF SOLAR HEATING AND OFF-PEAK ENERGY STORAGE INSTALLATIONS

C. B. WINN and R. C. WINN (Colorado State University, Fort Collins, CO) ASME, Transactions, Journal of Solar Energy Engineering, vol 105, Feb. 1983, p. 50-57. Research supported by the Electric Power Research Institute

It is well known that the widespread use of solar heating or cooling systems could lead to an increase in the cost of supply of power by the electric utilities. However, it is also recognized that by using appropriate control strategies in these systems the cost of supply may be reduced relative to that of electric resistance heating systems. Control strategies for solar heating systems and for off-peak heat storage systems have been developed and investigated in terms of utility cost of supply for the year 1990. This paper includes a discussion of results obtained for off-peak storage systems, solar heating systems, and combined solar and off-peak systems for the area served by Public Service Co. of New Mexico. (Author)

A83-23883#

CONVECTIVE HEAT LOSSES FROM FLAT-PLATE SOLAR COLLECTORS IN TURBULENT WINDS

R J KIND (Carleton University, Ottawa, Canada), D H GLADSTONE, and A D MOIZER ASME, Transactions, Journal of Solar Energy Engineering, vol. 105, Feb 1983, p. 80-85 Research supported by the Natural Sciences and Engineering Research Council refs

This paper presents results for convective heat transfer coefficients on the surface of flat-plate solar collectors mounted on a single-family residential building and exposed to the wind. The results were obtained by testing a 1/32 scale model in highly turbulent nonuniform flows which simulated the natural wind. For full-scale conditions, the heat transfer coefficients are two to three times lower than those given by a commonly used correlation. The coefficients show some sensitivity to wind direction but are insensitive to the characteristics of the wind and to architectural details of the building (Author)

A83-23884#

SIMPLIFIED CALCULATIONAL PROCEDURE FOR DETERMINING THE AMOUNT OF INTERCEPTED SUNLIGHT IN AN IMAGING SOLAR CONCENTRATOR

R B PETTIT, C N VITTITOE, and F BIGGS (Sandia National Laboratory, Albuquerque, NM) ASME, Transactions, Journal of Solar Energy Engineering, vol. 105, Feb 1983, p. 101-107 refs (Contract DE-AC04-76DP-00789)

A83-24353*# National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala.

ELECTRIC POWER - LOOKING AT REGENERATIVE SYSTEMS

J L MILLER (NASA, Marshall Space Flight Center, Huntsville, AL) Astronautics and Aeronautics, vol. 21, Mar 1983, p. 38-41

Photovoltaic solar array technology dominates NASA space station planning for the late 1980s, although the reduction of fabrication costs and the extension of service life for such arrays remain essential goals for research and development. Attention is given to concentrator arrays, in which highly reflective surfaces concentrate solar energy onto the solar cells. Two types of concentrator arrays are under consideration: one with a low geometric concentration ratio which after reflector losses can produce about 5 suns at the cell surface, and the other with a Cassegrainian concentrator that produces a flux level of 100 suns on the cell surface. Costs are reduced from the \$300/W for planar arrays to \$250/W and as little as \$100/W, respectively, in 1982 dollars. The storage of electrical energy by means of novel battery systems is also considered. O C

A83-24633#

MESOSCALE MAPPING OF AVAILABLE HOURLY SOLAR IRRADIANCE BY USE OF DATA COLLECTED BY 'METEOSAT'

Y H KERR (Centre National d'Etudes Spatiales, Toulouse, France) and C DELORME (Groupement pour le Developpement de la Teledetection, Toulouse, France) In: Remote sensing of arid and semi-arid lands, Proceedings of the International Symposium on Remote Sensing of Environment, Cairo, Egypt, January 19-25, 1982. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1982, p. 1249-1260

The use of Meteosat imagery for predicting the type of solar energy system, their dimensions, and storage capacity best fitted to local conditions is examined. Meteosat provides three bands of imagery every half hour in visible and IR wavelengths and can be implemented for measuring long term cloud cover trends and total solar irradiance. Trial studies were performed for cloud cover estimates daily over several months and for a three day period, and comparisons were made with ground truth for arid and semiarid sections of Africa and Southern Europe. Bidimensional histograms were generated and nebulosity was calculated according to threshold values in the visible and IR. Iteration with the IR data for the day of the lowest cloud cover provided estimated coinciding with ground measurements. In the short period tests, daily curves of brightness and apparent temperature registered by the Meteosat sensors were employed to state whether a day was cloudy or

not. Successful comparison was made with ground truth irradiance data. It is concluded that the Meteosat data is suitable for mapping large areas for insolation variability and intensity, and extensions to groundwater monitoring are indicated. M S K

A83-24761

REGULATION OF A SYSTEM WITH VARIABLE STRUCTURE

D D SWORDER (California, University, La Jolla, CA) In: Conference on Decision and Control, 20th, and Symposium on Adaptive Processes, San Diego, CA, December 16-18, 1981, Proceedings Volume 2. New York, Institute of Electrical and Electronics Engineers, 1981, p. 725-729 refs (Contract DE-AC03-78ET-20517, NSF ECS-80-03547)

The linearized process dynamics of the boiler in a solar-powered central receiver change abruptly when clouds pass over the heliostats which direct the sun's rays toward it. The steam temperature regulator used to control exit steam conditions must control a system with variable structure and discontinuous state trajectories. This paper investigates the quadratic-optimal control of such a system and gives the design equations for the optimal regulator. (Author)

A83-24896

THE SUN, OUR STAR

R W NOYES (Harvard University, Smithsonian Astrophysical Observatory, Cambridge, MA) Cambridge, MA, Harvard University Press, 1982. 268 p

Observational data, analytical models, and instrumentation used to study the sun and its evolution are detailed, and attention is given to techniques for converting solar energy to useful power on earth. The star ignited when the mutual gravitational attractions of dust and vapor in a primordial cloud in the Galaxy caused an inrush of accelerating particles which eventually became dense enough to ignite. The heat grew until inward rushing matter was balanced by outward moving radiative forces. The planets formed from similar debris, and solar radiation is suggested to have triggered the chemical reactions giving rise to life on earth. Visual, spectroscopic, coronagraphic, and UV observations of the sun from the ground and from spacecraft, particularly Skylab, are described, together with features of the solar surface, magnetic field, sunspots, and coronal loops. Models for the processes that occur in the solar interior are explored, as are the causes of solar flares. Attention is given to solar cells, heliostat arrays, wind turbines, and water turbines as means to convert, either directly or indirectly, the earth-bound solar energy to electrical and thermal power. Finally, the life cycle of the sun, about 9 billion yr in duration, is summarized, noting the current status of midlife. M S K

A83-25124

SOLAR TECHNOLOGY - A WHETHER REPORT

K FINNERAN Technology Review, vol. 86, Apr 1983, p. 48-54, 57-59

Progress in the use of solar energy for producing large quantities of electrical power is assessed. The practicality of different applications of solar energy has been demonstrated, and present activity focuses on reducing production costs, enhancing efficiency, and improving reliability. Solar cell production reached 6 MW in 1982, but cuts in government research funding will delay the arrival of cost-competitive photovoltaics for commercial applications in developed countries. Research is expanding on amorphous Si cells, which are cheaper to produce while having lower efficiencies than single crystal cells. An estimated 60,000-80,000 passive solar houses have been constructed since 1978, and work is proceeding on better thermal control in the houses and more elegant storage techniques, such as long-lasting phase change materials. Industrially, a 114-unit array of parabolic concentrators producing 3 MW is providing steam for electricity and processing in a clothing factory. Tests of the 10 MWe Solar One heliostat array power plant in Barstow, CA have encouraged plans for a 100 MWe plant. D H K

02 SOLAR ENERGY

A83-25144#

CAN INDUSTRY AFFORD SOLAR ENERGY

F. KREITH (Solar Energy Research Institute, Golden, CO) and R. BEZDEK (U.S. Department of the Treasury, Washington, DC) *Mechanical Engineering*, vol 105, Mar 1983, p. 35-41 refs

Falling oil prices and conservation measures have reduced the economic impetus to develop new energy sources, thus decreasing the urgency for bringing solar conversion technologies to commercial readiness at an early date. However, the capability for solar to deliver thermal energy for industrial uses is proven. A year-round operation would be three times as effective as home heating, which is necessary only part of the year. Flat plate, parabolic trough, and solar tower power plant demonstration projects, though uneconomically operated, have revealed engineering factors necessary for successful use of solar-derived heat for industrial applications. Areas of concern have been categorized as technology comparisons, load temperatures, plant size, location, end-use, backup requirements, and storage costs. Tax incentives have, however, supported home heating and not industrial uses, and government subsidies have historically gone to conventional energy sources. Tax credit programs which could lead to a 20% market penetration by solar energy in the industrial sector by the year 2000 are presented. D.H.K.

A83-25447

METAL-INSULATOR-SEMICONDUCTOR SILICON SOLAR CELLS

G. CHEEK and R. MERTENS (Leuven, Katholieke Universiteit, Heverlee, Belgium) *Solar Cells*, vol 8, Feb 1983, p. 17-32. Research supported by the National Fonds voor Wetenschappelijk Onderzoek refs

Developmental work to date on metal-insulator-semiconductor (MIS) solar cells for terrestrial applications is reviewed. MIS photovoltaics display an enhanced blue response, can be manufactured at relatively low temperatures, have comparatively high open-circuit voltages, and feature reduced shunting. High efficiencies have been produced by using silicon nitrides as a dielectric layer in grating type MIS cells. Further work is required on stability and degradation mechanisms, interfacial oxide properties, reproducibility, and the incorporation of low-cost materials such as prepassivated polycrystalline Si. It is suggested that MIS cells will not become economically competitive with p-n cells in the near- or mid-term. D.H.K.

A83-25449

ORGANIC SOLAR CELLS - A REVIEW

G. A. CHAMBERLAIN (Shell Research, Ltd., Thornton Research Centre, Chester, England) *Solar Cells*, vol. 8, Feb. 1983, p. 47-83. refs

The status of organic solar cell research is reviewed. The field is still in the early stages of development, but conversion efficiencies in sunlight of about 1% have been achieved. Special emphasis has been given to doping effects, carrier photogeneration and recombination. Improved understanding of the photovoltaic mechanism and the wide-ranging possibilities of molecular tailoring suggest that ultimate efficiencies of around 10% in Schottky barrier devices should be within reach. (Author)

A83-25534

CHEMICALLY VAPOR-DEPOSITED BLACK MOLYBDENUM FILMS OF HIGH IR REFLECTANCE AND SIGNIFICANT SOLAR ABSORPTANCE

E. E. CHAIN, B. O. SERAPHIN (Arizona, University, Tucson, AZ), and K. A. GESHEVA (Arizona, University, Tucson, AZ, B'lgarska Akademiia na Naukite, Tsentralna Laboratoriia po Si'ncheva Energiia i Novi Energiini Iztochnitsi, Sofia, Bulgaria) In *Metallurgical coatings 1981; Proceedings of the Eighth International Conference*, San Francisco, CA, April 6-10, 1981. Volume 1. Lausanne, Elsevier Sequoia, S.A., 1981, p. 387-392. Research supported by the B'lgarska Akademiia na Naukite, and AMAX Foundation refs (Contract XH-9-8217-1)

A83-25535

THERMAL DEGRADATION OF SOLAR COLLECTOR SURFACES

O. T. INAL, J. C. MABON, and C. V. ROBINO (New Mexico Institute of Mining and Technology, Socorro, NM) In: *Metallurgical coatings 1981; Proceedings of the Eighth International Conference*, San Francisco, CA, April 6-10, 1981. Volume 1. Lausanne, Elsevier Sequoia, S.A., 1981, p. 399-414 refs (Contract ER-78-84-4266)

Changes in the metal-to-metal-oxide ratios of electrodeposited black chrome and black zinc surfaces occurring during high-temperature exposure are investigated by X-ray diffractometry and field-ion microscope imaging. It is found that these ratios may decrease from 3.65 to 0.33 for black zinc and from 4.00 to 0.58 for black chrome with the increasing temperature of thermal exposure, the decrease being correlated with the degradation of the optical selectivity of the deposits. Black chrome surfaces are stable up to 500 C, whereas black zinc surfaces degrade optically at above 250 C. It is also shown that heat treating the particles comprising these surfaces makes the particles more spherical. V.L.

A83-25687#

PRELIMINARY TEST RESULTS FOR THE SMALL COMMUNITY SOLAR POWER SYSTEM

R. L. PONS and F. P. BODA (Ford Aerospace and Communications Corp., Aeronautics Div., Newport Beach, CA) *American Society of Mechanical Engineers, Winter Annual Meeting*, Phoenix, AZ, Nov. 14-19, 1982, 8 p. (ASME PAPER 82-WA/SOL-30)

The design feature, performance test results, and operational features of a parabolic dish concentrator small community power system being developed at JPL are described. The system, a prototype unit for modular energy systems of less than 10 MWe, uses multiple parabolic sections, a 20 kWe hermetically sealed organic Rankine cycle engine, and a permanent magnet alternator. The power component is a single stage axial flow turbine with an air-cooled condenser. A static dc/ac inverter and additional equipment condition the power for grid interface and synchronization. Software has been developed to permit remote, stand-alone operation, and to obtain steady performance during intermittent clouding. Each power module is equipped with microprocessors for virtually independent functioning. Separate control systems in each concentrator assembly govern positioning, fluid flow rate, and turbine speed. The system has produced 16.2 kWe continuous power at a net overall efficiency of 15.4% of the insolation. D.H.K.

A83-25689*# Jet Propulsion Lab., California Inst. of Tech., Pasadena

REGIONAL THERMAL AND ELECTRIC ENERGY OUTPUT OF SALT-GRADIENT SOLAR PONDS IN THE U.S.

M. J. SINGER and E. I. H. LIN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) *American Society of Mechanical Engineers, Winter Annual Meeting*, Phoenix, AZ, Nov. 14-19, 1982, 8 p. refs (ASME PAPER 82-WA/SOL-27)

Salt-gradient solar pond thermal and electrical energy output was calculated for each of twelve regions within the United States as part of an effort to assess solar pond applicability and extent of requisite physical resources on a regional basis. The energy output level is one of the key factors affecting the economic feasibility of solar ponds. Calculated thermal energy output ranges from 6.9 Wt/sq m in Fairbanks, Alaska, to 73.1 Wt/sq m in Daggett, California, at an energy extraction temperature of 45 C. The output ranges from 0.0 Wt/sq m in Fairbanks to 63.2 Wt/sq m in Daggett at 60 C. Electrical energy output ranges from 0.0 We/sq m in Fairbanks to 3.11 We/sq m in Daggett. Although these estimates constitute a reasonable basis for regional comparison, site-specific analysis must be performed for an actual application design. (Author)

A83-26061**THE URANYL ION, FLUORESCENT AND FLUORINE-LIKE - A REVIEW**

C. K. JORGENSEN (Geneve, Universite, Geneva, Switzerland) and R. REISFELD (Jerusalem, Hebrew University, Jerusalem, Israel) (Electrochemical Society, Meeting, Montreal, Canada, May 9-14, 1982.) Electrochemical Society, Journal, vol 130, Mar. 1983, p. 681-684. Swiss National Science Foundation refs (Contract SNSF-2,841,080)

The uranyl ion has rather unique stereochemistry, and its ultraweak electron transfer bands are compared with other transition-group spectra. The 6 most recent MO calculations are shown to be inconclusive about the distribution of the many excited levels. The first excited state has very different chemical properties compared with the ground state, reacts with polarizable cations and anions, and shows a potent photochemistry of electron and of hydrogen atom abstraction. Its fluorescence (with much higher quantum yield in glasses than in aqueous solution) can be used for flat-plate concentrators of solar energy. (Author)

A83-26064**AMORPHOUS SILICON PHOTOVOLTAIC MODULES**

Y. UCHIDA, H. SAKAI, N. FURUSHO, M. NISHIURA, and H. HARUKI (Fuji Electric Corporate Research and Development, Ltd., Yokosuka, Kanagawa, Japan) (Electrochemical Society, Meeting, Montreal, Canada, May 9-14, 1982.) Electrochemical Society, Journal, vol. 130, Mar 1983, p. 712-716. Research supported by the Agency of Industrial Science and Technology. refs

In hydrogenated amorphous silicon solar cells of 100 sq cm, the conversion efficiency of more than 6% has been obtained for the cells with metal/n-i-p/ITO/glass and ITO/n-i-p/SS structures under AM1 (100 mW/sq cm) illumination. The module structure and encapsulating materials suitable for a-Si solar cell were investigated to make a low cost module. Typical output power under AM1 illumination is 16W for the module composed of 40 sheets of ITO/n-i-p/SS cells with 10 x 10 sq cm area. The a-Si modules have been tested in various environments. The results show that the a-Si solar cells are highly resistive to high and low temperature, high humidity environments, and thermomechanical stress (Author)

A83-26065**THE GROWTH OF Zn3P2 BY METALORGANIC CHEMICAL VAPOR DEPOSITION**

J. LONG (Bell Telephone Laboratories, Inc., Murray Hill, NJ) Electrochemical Society, Journal, vol. 130, Mar 1983, p. 725-728

On the basis of recent studies, zinc phosphide (Zn3P2) appears to be a promising material for low-cost photovoltaic devices. Its advantages include a direct band gap of 1.5 eV and relatively cheap and abundant constituent elements. Previously, Zn3P2 for device applications has been grown mainly by techniques involving close space vapor transport. The present investigation is concerned with the first growth of Zn3P2 by the procedure of metalorganic chemical vapor deposition. The considered technique has the advantage that relatively low growth temperatures may be used in conjunction with the independent regulation of the Group II and Group V sources. The quality of the layers was found to be greatly dependent on the substrate material. Problems related to an occurrence of microcracks could be eliminated by using mica or silicon steel as the substrate. G.R.

A83-26882#**NEW MATERIALS FOR SOLAR CELLS - TANDEM CELLS [MATERIALE NOI PENTRU CELULE SOLARE - CELULE TANDEM]**

V. DOLOCAN (Bucuresti, Universitatea, Bucharest, Rumania) Studii si Cercetari de Fizica, vol 35, no 2, 1983, p. 162-176. In Rumanian refs

Cost efficiency in the manufacturing processes of the solar cell panels is discussed, noting the utilization of the III-V compound semiconductors (such as InSb or Ge) instead of silicon or gallium arsenide which have a complicated and expensive technology. A computation program is presented for a p-n junction using a set

of nonlinear differential equations and taking into consideration such parameters as the mobility, the life space and the forbidden band. It is concluded that new, economic technologies should be directed toward blocking the UV light, acrylic elastomers, waterproof wood and paper materials and cost efficient silicon and fluorocarbon materials. N.D.

A83-27131* Jet Propulsion Lab., California Inst. of Tech., Pasadena.**COMPARISON OF EVOLVING PHOTOVOLTAIC AND NUCLEAR POWER SYSTEMS FOR EARTH ORBITAL APPLICATIONS**

D. E. ROCKEY, R. M. JONES, and I. SCHULMAN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, p. 70-76. refs (Contract NAS7-100)

Photovoltaic and fission reactor orbital power systems are compared in terms of the end-to-end system power-to-mass ratios. Three PV systems are examined, i.e., a solid substrate with a cell array and a NiCd battery, a modified SEP array and an NiH2 battery, and a 62-micron Si cell array and a fuel cell. All arrays were modeled to be 13.5% efficient and to produce 25 kW dc. The SP-100 reactor consists of the heat source, radiation shield, heat pipes to transfer thermal energy from the reactor to thermoelectric elements, and a waste heat radiator. Consideration is given to system applications in orbits ranging from LEO to GEO, and to mission durations of 1, 5, and 10 yr. PV systems are concluded to be flight-proven, useful out of radiation belts, and best for low to moderate power levels. Limitations exist for operations where atmospheric drag may become a factor and due to the size of a large PV power supply. Space nuclear reactors will continue under development and uses at high power levels and in low altitude orbits are foreseen. D.H.K.

A83-27132* TRW Defense and Space Systems Group, Redondo Beach, Calif.**SOLAR ARRAY SWITCHING POWER MANAGEMENT**

J. E. CASSINELLI, L. D. SMITH (TRW Defense and Space Systems Group, Redondo Beach, CA), and M. VALGORA (NASA, Lewis Research Center, Cleveland, OH) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, p. 77-82.

Solar array power switching concepts are explored for a 250 kW manned LEO platform, a 50-250 kW load for an orbit transfer vehicle (OTV), and an unmanned platform with a 50 kW load in GEO. A solar array switching power management (SASPM) system is under study to satisfy the switching demands. Direct connections to arrays would be implemented for voltage regulations, power distribution, and the capability of reconfiguring the arrays to meet requirements. Mission characteristics that would require the power sources were explored. The LEO platform was projected to use a concentrator, have no reconfigurability, use 250 NiH2 batteries, supply 80-0 Vdc to an ion drive, and have a 20-30 yr life. Both GEO and OTV arrays were planar, would feature reconfigurability, and supply 800 Vdc to an ion drive. NiH2 batteries would be on the OTV, while the GEO spacecraft would use AgH2 cells. A block diagram of the basic switching configuration is presented. D.H.K.

A83-27135**HIGH-EFFICIENCY SPACECRAFT POWER CONVERSION TECHNIQUES**

L. G. MEARES (McDonnell Douglas Astronautics Co., St Louis, MO) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p. 94-95

Circuit design techniques used to optimize the efficiency of a buck regulator are presented. Improved circuitry is proven to reduce losses in the switching element, filter inductor, and drive electronics.

02 SOLAR ENERGY

The switching frequency is then selected for optimal performance.
(Author)

A83-27138* Washington Univ., Seattle.

RADIATIVE ENERGY RECEIVER FOR HIGH PERFORMANCE ENERGY CONVERSION CYCLES

D. RAULT and A. HERTZBERG (Washington, University, Seattle, WA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, p. 113-118
(Contract NAG3-16)

An analysis of gas dynamic processes pertinent to the functioning of earth-based and space-based solar electric power plants is presented, with attention given to potassium vapor as the working fluid. A device is described which features focused photon absorption by a nontransparent flowing gas. The feed flow is effected around the outside walls of a cavity receiver to raise efficiencies by trapping reemitted energy. A theoretical study of the interaction of a photon flux with a coaxial particle flux was performed, with the receiver flow treated as a Graetz flow. The critical parameters were defined, including a figure of merit as the gas enthalpy increase to absorbable energy ratio. A small-scale laboratory model was tested in comparison with the theoretically obtained values. Less than 15% of the absorbed energy was lost through dissipation while an 80% conversion efficiency was attained.
D.H.K.

A83-27139* Boeing Aerospace Co., Seattle, Wash

IMPROVED THERMOPHOTOVOLTAIC POWER SYSTEM

W. E. HORNE, A. C. DAY (Boeing Aerospace Co., Seattle, WA), and L. CRABTREE (NASA, Marshall Space Flight Center, Huntsville, AL) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, p. 119-124 refs

Improvements in thermophotovoltaic (TPV) system design to ease the geometry and performance requirements are discussed. A TPV system usually consists of a receiver cavity lined with reflective materials and Si solar cells. A suspended central absorber/radiator converter absorbs solar energy and heats to an equilibrium temperature of 2000-23,000 K. Radiant heat at that temperature is well matched to Si solar cell low energy excitation. An elliptical geometry cavity is described which bypasses normal cell mounting problems by having the cells fixed to a plate positioned between the loci of the cavity. Incoming concentrated solar flux is absorbed by the absorber/radiator, which emits the radiation for reflection from the cavity walls to eventually pass through the solar cell wall. Dielectric stack coatings can be used on the walls. A theoretical model was developed for the performance and verified with a laboratory apparatus. Efficiencies of nearly 30% were found practical with existing materials and technologies.
D.H.K.

A83-27140*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio

A NEW STRATEGY FOR EFFICIENT SOLAR ENERGY CONVERSION - PARALLEL-PROCESSING WITH SURFACE PLASMONS

L. M. ANDERSON (NASA, Lewis Research Center, Cleveland, OH) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p. 125-130 refs

(Previously announced in STAR as N82-29354)

A83-27147*

DEVELOPMENT OF MANAGEMENT TECHNOLOGY FOR LARGE POWER SYSTEMS

D. K. DECKER, A. MESSNER (TRW, Inc., TRW Space and Technology Group, Redondo Beach, CA), and J. GRAVES (NASA, Marshall Space Flight Center, Huntsville, AL) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p. 165-170
(Contract NAS8-33198)

Autonomous power management has been proposed as a method to perform optimization of power subsystem performance in connection with the management of multikilowatt space platforms. A concept for a 250-kW utility-type power subsystem was developed. A Cassegrain concentrator solar array primary source is conditioned by a solar array switching unit which supplies seventeen 220 +20 Vdc power channels. A power management subsystem provides the monitoring and control of the overall electrical power subsystem. The discussed system concept for autonomous management of high power space platforms utilizes on-board microprocessors in a decentralized data management architecture. A data bus protocol and a data bus contention resolution scheme were selected in conjunction with the decentralized management architecture.
G R

A83-27148

SOLAR ARRAY POWER MANAGEMENT

W. A. MAGEE, R. M. MARTINELLI, and J. H. HAYDEN (Hughes Aircraft Co., Space and Communications Group, Los Angeles, CA) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p. 171-174

In designing a spacecraft power bus, a number of differential factors have to be considered. The present investigation is concerned with the thermal dissipation problem. Approaches to limit the solar array voltage are examined, and a method is discussed to minimize the power which must be dissipated within the spacecraft. Attention is given to a full shunt limiter circuit, the switching tap limiter, and the linear tap limiter. The tap limiter design has been flown on a variety of satellites. The full shunt limiter was also flight tested, while the switching tap limiter is in the development stage and shows promise in implementing multikilowatt power systems.
G R

A83-27153

INTEGRATION OF LARGE ELECTRICAL SPACE POWER SYSTEMS

J. H. HAYDEN (Hughes Aircraft Co., Space and Communications Group, El Segundo, CA) and A. KIRPICH (General Electric Co., Philadelphia, PA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p. 199-204.

Methods for combining solar/battery space power plants with space nuclear reactor power plants are discussed, noting the eventual application for a manned space station. The load will have both dc and ac components, and it is expected that solar/battery power will be used in the initial growth stages of the station. The battery power is regarded as a dc source only, and all power is inverted by equipment located near the end use. Shunt regulation can be implemented to handle excess power, especially with regard to a concept of an expanding power supply. A direct energy transfer system (DETS) is described, and involves channeling power directly to loads, with excess power radiated away by the shunt regulator. Power processing controls would respond to voltage deviations. A block diagram is furnished for a reliable high voltage battery modular array which would be capable of furnishing 28 kW demand. If the energy source is a constant speed alternator, then constant speed operation, load leveling, and adaptation of the alternator to different voltages would be necessary.
M S K

A83-27179* Jet Propulsion Lab., California Inst of Tech., Pasadena

APPLICATION OF ELECTROCHEMICAL ENERGY STORAGE IN SOLAR THERMAL ELECTRIC GENERATION SYSTEMS

R DAS, S KRAUTHAMER, and H FRANK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 2. New York, Institute of Electrical and Electronics Engineers, 1982, p 620-624

This paper assesses the status, cost, and performance of existing electrochemical energy storage systems, and projects the cost, performance, and availability of advanced storage systems for application in terrestrial solar thermal electric generation. A 10 MWe solar plant with five hours of storage is considered and the cost of delivered energy is computed for sixteen different storage systems. The results indicate that the five most attractive electrochemical storage systems use the following battery types: zinc-bromine (Exxon), iron-chromium redox (NASA/Lewis Research Center, LeRC), sodium-sulfur (Ford), sodium-sulfur (Dow), and zinc-chlorine (Energy Development Associates, EDA) (Author)

A83-27229

DESIGN, FABRICATION, AND INITIAL TESTING OF SOLAR ONE RECEIVER

R G SURETTE, A. E. MOORE, and R. P. PAUCKERT (Rockwell International Corp., Rocketdyne Div., Canoga Park, CA) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p 1463-1467

Receiver design and test performance at the DoE Solar One multi-MW heliostat array solar tower power plant are presented. The 1818 suntracking heliostats reflect light to an elevated receiver to produce superheated steam for driving a turbine generator. The tower is 211 ft tall, topped by a 70 ft tall 24-external panel receiver. Each panel has a separate control system covering the valves, flow, panel temperature, steam temperature, and the heat flux. Rated outlet temperature is 960 F at 1515 psia, with the total thermal flux absorbed being 42.7 MWt rated and 35.2 MWt derated. Heater tubes are made of bent 0.5 in. Incoloy. The panels are sandblasted and painted with black pyromark paint, featuring a 0.95 absorptivity. Further tests will be performed to examine the interface with a thermal storage system. (Author)

A83-27231

SOLAR RESIDENTIAL TOTAL ENERGY SYSTEM USING THE SODIUM HEAT ENGINE - A CONCEPT STUDY

K. SUBRAMANIAN and T. K. HUNT (Ford Motor Co., Dearborn, MI) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p 1474-1480. refs (Contract DE-AC02-79ER-10347)

A83-27232* Jet Propulsion Lab., California Inst of Tech., Pasadena

COMPARISON OF ADVANCED THERMAL AND ELECTRICAL STORAGE FOR PARABOLIC DISH SOLAR THERMAL POWER SYSTEMS

T FUJITA, G C BIRUR, J. M. SCHREDDER, J M BOWYER, and H I AWAYA (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p 1481-1486. Research sponsored by the U S Department of Energy and NASA. refs

Parabolic dish solar concentrator cluster concepts are explored, with attention given to thermal storage systems coupled to Stirling and Brayton cycle power conversion devices. Sensible heat storage involving molten salt (NaOH), liquid sodium, and solid cordierite bricks are considered for 1500 F thermal storage systems. Latent

heat storage with NaF-MgF₂ phase change materials are explored in terms of passive, active, and direct contact designs. Comparisons are made of the effectiveness of thermal storage relative to redox, Na-S, Zn-Cl, and Zn-Br battery storage systems. Molten lead trickling down through a phase change eutectic, the NaF-MgF₂, formed the direct contact system. Heat transport in all systems is effected through Inconel pipes. Using a cost goal of 120-150 mills/kWh as the controlling parameter, sensible heat systems with molten salts transport with either Stirling or Brayton engines, or latent heat systems with Stirling engines, and latent heat-Brayton engine with direct contact were favored in the analyses. Battery storage systems, however, offered the most flexibility of applications. (Author)

A83-27233

ADVANCED COMPONENT RESEARCH IN THE SOLAR THERMAL PROGRAM

C. T. BROWN (Georgia Institute of Technology, Atlanta, GA) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p 1487-1491. refs

The capabilities, equipment, and programs of the DoE advanced components test facility (ACTF) for developing solar thermal technologies are reviewed. The ACTF has a heliostat field, a rigid structural steel test tower at the geometric center of the heliostat field, an experiment platform on the tower, a heat rejection system, and computerized instrumentation. Tests have been performed on a directly-heated fluidized-bed solar receiver, a high pressure single-pass-to-superheat steam generator, a liquid Na heat pipe receiver, a flash pyrolysis biomass gasifier, and a grid-connected Stirling engine powered electrical generator. Helium served as the 720 C working fluid in the Stirling engine, and 18.8 kWe continuous was produced for the grid. Verified components qualified for further development are subjected to larger scale testing at a 5 MW facility in Albuquerque, NM. (Author)

A83-27234

DIRECT-CONTACT AIR/MOLTEN SALT HEAT EXCHANGE FOR SOLAR THERMAL SYSTEMS

J. D. WRIGHT (Solar Energy Research Institute, Golden, CO) and C. DAGINCOURT (New Hampshire University, Durham, NH) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1492-1497. refs

Heat exchangers employing direct contact between molten draw salt and air were studied for use in solar industrial process heat (IPH) systems. Direct-contact systems consisting of a fin-tube preheater and a spray or packed column were compared to conventional heat exchangers. Direct contact reduced the IPH system cost by 5%-10%. The direct-contact heat exchangers cost only 15%-30% as much as comparable conventional exchangers. However, the rate of salt degradation by CO₂ and H₂O must be determined to see if it is acceptable. (Author)

A83-27235

EVALUATION AND APPLICATION OF SOLID THERMAL ENERGY CARRIERS IN A HIGH TEMPERATURE SOLAR CENTRAL RECEIVER SYSTEM

P. K. FALCONE, J. E. NORING, and C. E. HACKETT (Sandia National Laboratory, Livermore, CA) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1498-1503. Research supported by the U S Department of Energy. refs

The use of small refractory pebbles or sand as the working fluid in a high temperature solar central receiver system has been examined. Such a receiver appears to have significant advantages over current designs for high temperature receivers which use air or gas as the working fluid. A conceptual design is proposed and

02 SOLAR ENERGY

analyzed to determine the optimum particle material and size as well as the system configuration and thermodynamics. (Author)

A83-27236* Cleveland State Univ., Ohio. **PERFORMANCE DEGRADATION AND CLEANING OF PHOTOVOLTAIC ARRAYS**

T. J. SHESKIN, G. C. CHANG (Cleveland State University, Cleveland, OH), R. C. CULL, and W. D. KNAPP (NASA, Lewis Research Center, Cleveland, OH) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1504-1510 refs

NASA tests results from an 18 mo program of cleaning silicone-encapsulated and glass fronted solar cell panels in urban and desert environments to examine the effects of cleaning on module performance are reported. The panels were cleaned on weekly, monthly, quarterly, or semi-annual basis, while other panels of the same construction were not cleaned and served as controls. Commercially-available detergents and city water were employed for the tests, and the measurements were maintained of the modules' continuing short-circuit current output. The decay of the output was determined by least square regression analyses. Performance degradation was noticeably less in glass covered, rather than silicone-encapsulated modules which decayed faster in urban than in desert environments. Lower frequency cleanings are recommended where labor costs are high M.S.K.

A83-27237* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

EVALUATION OF SOLAR REFLECTIVE SURFACES FOR DISH CONCENTRATORS

F. BOUQUET (California Institute of Technology, Jet Propulsion Laboratory, Applied Mechanics Technology Section, Pasadena, CA) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1511-1516 Research sponsored by the U.S. Department of Energy and NASA refs (Previously announced in STAR as N81-16581)

A83-27238 **ON INSOLATION MEASUREMENTS USING PYRANOMETERS AND SOLAR CELL DEVICES**

M. C. RUSSELL, P. RAGHURAMAN, and G. W. HART (MIT, Lexington, MA) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1517-1524. Research sponsored by the U.S. Department of Energy. refs

In evaluating the performance of a solar photovoltaic (PV) system, accurate measurement of total insolation is crucial. At present, insolation measurements are made by using one of two calibrated instruments: a pyranometer or a PV standard cell detector. Depending on the nature of the insolation, these devices can produce different readings under identical illumination. The present work addresses itself to quantitatively gauging this difference. Correction factors are established which, when applied to pyranometer readings, will simulate the response of specific calibrated solar cells. (Author)

A83-27239 **SOLERAS SOLAR ACTIVE COOLING FIELD TEST OPERATIONS**

J. WILLIAMSON and R. MARTIN (Midwest Research Institute, Kansas City, MO) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1527-1530.

Four small-scale commercial size solar cooling systems being tested in Arizona as part of the SOLERAS program are described, together with 1981 performance summaries. A 63 kW air-cooled Rankine cycle system powered by parabolic troughs is used to

cool a one-story office building. The system has both hot and cold storage tanks and uses R-11 fluid. A 49 kW Rankine cycle system driven by 218.5 sq m of evacuated tube collectors features direct expansion cooling of part of an office building, as well as part-time electrical generation for the grid. A water-absorption cycle system with 53 kW of power from 133.8 sq m of tracking parabolic trough receivers is employed to cool a warehouse office area. The system includes a hot storage tank and ground-mounted solar energy collection. Computer room cooling is provided by the fourth system, a 35 kW air-cooled absorption system featuring 89.2 sq m of Fresnel lens collectors mounted roof-top. Design simplicity has been found to be mandatory for performance optimization, thereby ruling out cogeneration. Also, the use of both hot and cold storage has proven beneficial from cost and operational points of view M.S.K.

A83-27240 **OPERATIONAL RESULTS FROM THE SAUDI SOLAR VILLAGE PHOTOVOLTAIC POWER SYSTEM**

F. S. HURAIH, A. AL-SANI, and B. H. KHOSHAIM In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1531-1534.

A83-27243 **NATIONAL PROJECT OF NEW ENERGY DEVELOPMENT IN JAPAN**

T. HOMMA (Tsukuba, University, Sakura, Ibaraki, Japan) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1550-1555

Programs and projects that are part of the Japanese government Sunshine Project are outlined, with an emphasis on solar energy conversion. Prototype plants are being built to utilize solar, geothermal, hydrogen, wind, and ocean thermal energy, as well as to liquefy and gasify coal. Solar heating, cooling, thermal power, and photovoltaic systems are being tested. One MW mirror/parabolic trough concentrator and central tower solar power plants are being constructed. The mirror system features reflective facets on a stepped array directing light to a parabolic reflector, which concentrates the energy onto collector tubes. A 6 kW hybrid solar cell/thermal system was completed in 1980, and the data from its operation are being used in the manufacture of a 30 kW system with 5 kWe and 25 kWt. M.S.K.

A83-27244 **DEVELOPMENT OF SOLAR TOTAL ENERGY SYSTEM FOR INDUSTRIAL SECTORS**

T. TANAKA, T. TANI, S. SAWATA, K. SAKUTA, and I. TSUDA (Ministry of International Trade and Industry, Electrotechnical Laboratory, Sakura, Ibaraki, Japan) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1556-1561.

A83-27245 **USE OF PARABOLIC TROUGH COLLECTORS FOR RESIDENTIAL/LIGHT COMMERCIAL SOLAR COOLING SYSTEMS**

R. J. COPELAND (Solar Energy Research Institute, Golden, CO) and J. R. PARSONS (Tennessee, University, Knoxville, TN) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1562-1567. refs

A83-27246

PERFORMANCE AND OPERATIONAL ANALYSIS OF A LIQUID DESICCANT OPEN-FLOW SOLAR COLLECTOR

P. G. GRODZKA and S. S. RICO (Lockheed Missiles and Space Research and Engineering Center, Huntsville, AL) In IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1568-1572 refs

Theoretical predictions of the heat and mass transfer in an open flow solar collector used in conjunction with an absorption chiller are compared with performance data from a rooftop system. The study focuses on aqueous solutions of a hygroscopic salt, e.g., LiCl, flowing continuously over a solar absorbing surface. Water in the solution sublimates to a region of lower vapor pressure, i.e., the atmosphere. Direction of the water-depleted desiccant to a storage volume and then to circulation around an evaporator unit permits operation of a solar-powered air conditioner. A closed form solution was defined for the heat and mass transfer, along with a finite difference solution. The system studied comprised a sloped roof top with 2500 sq ft of asphalt shingles, collector pipes beneath the shingles, and two 500 gal storage tanks. Relatively good agreement was found between the models and the recorded data, although some discrepancies were present when considering temperatures and performance at specific times of day. The measured 30-40% efficiencies indicated that further development of the system is warranted. M.S.K.

A83-27247

AN ANALYSIS OF THE COST/PERFORMANCE CHARACTERISTICS OF PASSIVE SOLAR MATERIALS AND COMPONENTS

A. H. CREMEANS (Mueller Associates, Inc., Washington, DC), R. OSWALD (Total Environmental Action, Inc., Washington, DC), J. G. SHINGLETON, and P. SULLIVAN (Enersource, Inc., Washington, DC) In IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1573-1577

A cost/performance method was used to evaluate passive solar building heating and conservation techniques as a guide to DOE solar planning efforts. Attention was given to triple glazing, reflective films, low emissivity film, heat absorbing glass, and several prospective thermal storage technologies. A simulated commercial building and various residence designs were considered, along with sites in cold, hot and dry, and hot and humid environments. The heating alternatives were studied for both types of buildings, while glazing techniques were extended to commercial buildings. The critical factor was the ratio of installed cost to the incremental energy savings realized. Triple glazing was effective in residences, but not in commercial buildings, where heat absorbing glass was preferred. Reflective films were highly successful in hot climates, where cooling loads could be reduced by 45%. Movable shading and insulation were cost effective in hot climates. Water thermal storage was best in all climates, while selective surfaces were best fitted to a trombe wall in a cold climate. M.S.K.

A83-27249* Jet Propulsion Lab., California Inst of Tech., Pasadena

U.S. WELDING TECHNOLOGY - CONSTRAINTS TO SPACE IMPLEMENTATION

P. M. STELLA (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p. 1584-1588 NASA-supported research refs

U.S. and European efforts to develop welding techniques for satellite solar arrays are described. Soldering practices in the U.S. have benefitted from Mo solders, which are well fitted to Si solar cell material thermal characteristics. Analyses have indicated that welds are the preferred method for interconnections and bonds. Extensive work has been done with the parallel gap resistance

method (RW), which involves process heat generated by passing a current through resistive layers. Confining the primary heat input to the interconnector/cell contact interface results in welds being formed beneath both electrodes. Pulse welding has become the dominant RW technique in Europe, while ultrasonic welding is used in the U.S., silver is employed as the interconnect material on both continents. The bonding techniques have been developed empirically instead of theoretically. An IR inspection technique has been produced for monitoring the weld temperature. M.S.K.

A83-27250* TRW, Inc., Redondo Beach, Calif CASSEGRAINIAN CONCENTRATOR SOLAR ARRAY EXPLORATORY DEVELOPMENT MODULE

R. E. PATTERSON (TRW, Inc., Space Technology Group, Redondo Beach, CA) and W. L. CRABTREE (NASA, Marshall Space Flight Center, Huntsville, AL) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1589-1594. refs

A miniaturized Cassegrainian concentrator solar array concept is under development to reduce the cost of multi-kW spacecraft solar arrays. A primary parabolic reflector directs incoming solar energy to a secondary, centrally mounted inverted hyperbolic reflector and down onto a solar cell mounted on an Mo heat spreader on a 0.25 mm thick Al heat fin. Each unit is 12.7 mm thick, which makes the concentrator assembly roughly as thick as a conventional panel. The output is 100 W/sq and 20 W/kg, considering 20% efficient Si cells at 100 suns. A tertiary light catcher is mounted around the cell to ameliorate optic errors. The primary reflector is electroformed Ni with protective and reflective coatings. The cells have back surface reflectors and a SiO₂ antireflective coating. An optical efficiency of 80% is projected, and GaAs cells are being considered in an attempt to raise cell efficiencies to over 30%. M.S.K.

A83-27254* Rockwell International Corp., Seal Beach, Calif DESIGN OF LARGE, LOW-CONCENTRATION-RATIO SOLAR ARRAYS FOR LOW EARTH ORBIT APPLICATIONS

S. J. NALBANDIAN and E. P. FRENCH (Rockwell International Corp., Space Operations/Integration and Satellite Systems Div., Seal Beach, CA) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1613-1618 refs

(Contract NAS8-34214)

A83-27255* Jet Propulsion Lab., California Inst of Tech., Pasadena SPACE SOLAR CELL TECHNOLOGY DEVELOPMENT - A PERSPECTIVE

J. SCOTT-MONCK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p. 1619-1623 NASA-supported research refs

The developmental history of photovoltaics is examined as a basis for predicting further advances to the year 2000. Transistor technology was the precursor of solar cell development. Terrestrial cells were modified for space through changes in geometry and size, as well as the use of Ag-Ti contacts and manufacture of a p-type base. The violet cell was produced for Comsat, and involved shallow junctions, new contacts, and an enhanced antireflection coating for better radiation tolerance. The driving force was the desire by private companies to reduce cost and weight for commercial satellite power supplies. Liquid phase epitaxial (LPE) GaAs cells are the latest advancement, having a 4 sq cm area and increased efficiency. GaAs cells are expected to be flight ready in the 1980s. Testing is still necessary to verify production techniques and the resistance to electron and photon damage.

02 SOLAR ENERGY

Research will continue in CVD cell technology, new panel technology, and ultrathin Si cells
MSK

A83-27256

CURRENT DEVELOPMENTS IN SILICON SPACE CELLS

P. A. ILES (Applied Solar Energy Corp., City of Industry, CA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1624-1626.

The technology base for current production lines of Si solar cells for space applications is reviewed, together with emerging developmental areas. Sawn single-crystal cells formed with shallow junctions, narrow grids, and back surface reflectors are currently manufactured. Additional features include multiple antireflection coatings, back surface fields, and efficiencies in the 12-14.5% range. Thin cells with areas up to 36 sq cm are being developed, and research is proceeding on ultrapure Si starter material in order to enhance radiation tolerance. Attention is being given to array interactions, with an eye to multi-kW structures. Experimentation is also proceeding on welded cell contacts, larger cells, concentrator arrays to exceed 18% efficiency at 100 suns, and specialized purpose cells which are self-annealing and can withstand high temperatures.
M.S.K.

A83-27257

ADVANCED CELL DESIGNS FOR WELDED ARRAYS

M. N. GIULIANO and J. H. WOHLGEMUTH (Solarex Corp., Rockville, MD) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1627-1630.

The possibility of welding solar cells intended for space applications in a way that deepens the junction under the welded contact area and placing both contacts on the back of the cells is considered. A eutectic bonding technique can be implemented to prevent electrical and mechanical damage to the shallow diffused junction by the production of a deeper p-n junction underneath the contact point. A gold-silicon system, in use since transistors were first introduced, becomes molten above 370 C, and if an n-type dopant like P or Sb is present in the melt the recrystallized Si becomes a doped n-type. Gold-clad MO or kovar tabs have proven useful as welding contacts. The dual back contacts can be effected through integral feed-through holes, preferably sloped, which allows evaporated or plated metal grid contacts to flow continuously down the sides of the holes to the back metallization.
M.S.K.

A83-27258#

SPACE APPLICATIONS OF GALLIUM ARSENIDE SOLAR CELLS

T. M. TRUMBLE (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1631-1634.

A tradeoff analysis of gallium arsenide (GaAs) versus silicon (Si) solar cells is presented using a high radiation orbit, a typical array temperature and solar array component weights as selected from the present Global Positioning System (GPS) satellite. The scenario presented provides a quick method for evaluating GaAs and Si solar cell assemblies on an equal weight basis or on a 1 for 1 substitution basis.
(Author)

A83-27259

STATUS OF GAAS SOLAR CELLS FOR SPACE POWER APPLICATIONS

G. S. KAMATH (Hughes Research Laboratories, Malibu, CA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1635-1639. refs

Manufacturing and performance characteristics of GaAs solar cells for space applications are described, with attention given to cost factors. Cells for space use have a thin (AlGa)As window layer and a junction depth less than 0.5 micron, which minimize optical absorption losses and radiation damage, respectively. Cell processing consists of preparation of the epitaxial cell structure, introduction of metallic contacts, and application of an antireflective coating. Liquid phase epitaxy is used in the first step and can produce eighty 2 x 2 sq cm cells in one batch. Efficiencies in excess of 21.5% are projected in the 1980s, with current levels exceeding 16%. Reproducible cell contacts have been temperature cycle and humidity qualified for space. Concentrator configurations at 100 suns boost efficiencies above 22%, and GaAs cells at 500 suns have been operated in terrestrial applications. Mass production is expected to lower GaAs cell costs to equivalence with Si cell costs, and installation on satellite solar panels is expected in the near term.
M.S.K.

A83-27260*

SINGLE AND MULTI-JUNCTION SPACE SOLAR CELLS GROWN BY ORGANOMETALLIC VAPOR PHASE EPITAXY /OM-VPE/

P. G. BORDEN, R. A. LARUE, M. J. LUDOWISE, and P. E. GREGORY (Varian Associates, Palo Alto, CA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1640-1643.
(Contract NAS3-22232, XP-9-8081-1)

A83-27274

STIRLING ENGINES FOR SOLAR POWER GENERATION IN THE 50 TO 500 KW RANGE

D. WELLS, W. PERCIVAL (United Stirling, Inc., Alexandria, VA), C. BRATT, K. ROSENQVIST, and J. BERNTELL (United Stirling, Malmö, Sweden) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1749-1754. refs

Qualitative analyses are presented of solar Stirling power modules in terms of the engines, the concentrators, and the interaction between the size and efficiency of the modules with the cost of the system. A test unit with a parabolic dish concentrator has furnished 31.6 kWe using an 1800 rpm, 93% efficient permanent magnet alternator. Operating temperatures were 750 C, and engine efficiencies reached 38%. Point focus parabolic dishes, tracking heliostats, and stationary concentrators with tracking receivers are being examined. The engine cost has been projected to be only a small part of the total unit cost in mass production, and parabolic dishes are the lowest-cost configuration for manufacturing. Enclosing the dishes in greenhouses can lessen erosion of the surfaces. Foamglass has been identified as the most cost-effective concentrator material. Design alternatives for a 50-500 kW power array are described.
M.S.K.

A83-27301**SOLAR THERMIONIC ENERGY CONVERTER EXPERIMENT**

D. GOODALE, D. LIEB (Thermo Electron Corp., Waltham, MA), and D. NEALE (Georgia Institute of Technology, Atlanta, GA) In IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 4 New York, Institute of Electrical and Electronics Engineers, 1982, p 1924-1928 refs (Contract DE-AC02-76ET-11291)

The results of installation of a single thermionic converter at the focus of the heliostat array at the DOE Advanced Components Testing Facility are reported. Attention was given to heat flux cycling, control of the operating point, and the mounting arrangements. A maximum heat flux of 40-60 W/sq cm was deposited on a CVD SiC thermionic converter, with a total flux equal to 1300 suns and 325 kWt. The temperature at the focus reached 2166 K maximum, with the maximum emitter temperature reaching 1400 K. Low electricity generation levels were recorded due to the emitter temperature, which needed to reach 1800 K. Addition of a solar cavity is expected to enhance performance in future tests. M S K

A83-27315**REVERSIBLE CHEMICAL REACTIONS FOR ENERGY STORAGE IN A LARGE-SCALE HEAT UTILITY**

R G NIX, P W. BERGERON (Solar Energy Research Institute, Golden, CO), and R E WEST (Solar Energy Research Institute, Golden, Colorado, University, Boulder, CO) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 2019-2024 refs

This paper describes a study of the feasibility of using either $\text{Ca}(\text{OH})_2$ or $\text{CH}_4\text{-CO}_2$ reaction systems for long-duration storage in a central receiver, solar energy facility. The system is required to operate 262 MW(t) (8.95×10 to the 8th Btu/h) as 4.14-MPa (600-psig), 400 C (750 F) superheated steam, with usage split evenly among 10 users clustered in an industrial park. Results indicate that use of a solar thermal system with long-duration storage of either thermomechanical or direct thermal energy (molten draw salt) is probably not justified when compared to the use of coal-fired boilers for steam generation. However, solar thermal systems with either thermochemical or direct thermal energy storage may be competitive with oil- or natural gas-fired boilers if the cost of the solar energy supplied to the storage system is sufficiently low and the costs of oil and natural gas have escalated to a sufficiently high level. (Author)

A83-27316**COST AND PERFORMANCE OF THERMAL STORAGE CONCEPTS IN SOLAR THERMAL SYSTEMS, PHASE 2-LIQUID METAL RECEIVERS**

A. W. MCKENZIE (Stearns-Roger Services, Inc., Denver, CO) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 4 New York, Institute of Electrical and Electronics Engineers, 1982, p. 2025-2031 refs

Cost and performance of various thermal storage concepts in a liquid metal receiver solar thermal power system application have been evaluated. The objectives of this study are to provide consistently calculated cost and performance data for thermal storage concepts integrated into solar thermal systems. Five alternative storage concepts are evaluated for a 100-MW(e) liquid metal-cooled receiver solar thermal power system for 1, 6, and 15 hours of storage: sodium 2-tank (reference system), molten draw salt 2-tank, sand moving bed, air/rock, and latent heat (phase change) with tube-intensive heat exchange (HX). The results indicate that the all sodium 2-tank thermal storage concept is not cost-effective for storage in excess of 3 or 4 hours; the molten draw salt 2-tank storage concept provides significant cost savings over the reference sodium 2-tank concept, and the air/rock storage concept with pressurized sodium buffer tanks provides the lowest

evaluated cost of all storage concepts considered above 6 hours of storage (Author)

A83-27317**HIGH-TEMPERATURE MOLTEN SALT SOLAR THERMAL SYSTEMS**

R J COPELAND (Solar Energy Research Institute, Golden, CO), J. W. LEACH (North Carolina State University, Raleigh, NC), and G STERN In IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4 New York, Institute of Electrical and Electronics Engineers, 1982, p 2032-2036 refs

Conceptual designs of a solar thermal central receiver and a thermal storage subsystem were analyzed to estimate thermal losses and to assess the economics of high-temperature applications with molten salt transport fluids. Modifications to a receiver design being developed by the Martin Marietta Corporation were studied to investigate possible means for improving efficiency at high temperatures. Computations were made based on conceptual design of internally insulated high temperature storage tanks to estimate cost and performance. A study of a potential application of the system for thermochemical production of hydrogen indicates that thermal storage at 1100 C will be economically attractive. (Author)

A83-27976**OPEN-CIRCUIT VOLTAGES ACROSS TWO JUNCTIONS IN $\text{N}^{+}/\text{P-P}^{+}/\text{P}^{+}$ SOLAR CELLS UNDER HIGH ILLUMINATION LEVELS**

R V SINGH and C M SINGAL (Roorkee, University, Roorkee, India) Solar Cells, vol 8, Mar. 1983, p 97-123. Research supported by the Indian National Science Academy and University Grants Commission of India refs

The junction and Debye potentials in solar cells were evaluated theoretically at different illumination levels and various thicknesses of the p-type base layer of an $\text{n}^{+}\text{-p-p}^{+}$ cell. Uniform doping was assumed in all cell regions, as was a uniform carrier generation rate. A formulation of the current flowing through the $\text{n}^{+}\text{-p}$ and p-p^{+} regions was developed. The ambipolar diffusion equations were employed in the analysis, and open-circuit voltages at the two junctions were quantified by assuming a zero current flow through each junction. Junction voltages increased with decreasing cell thickness, and saturation was seen to occur at high illumination levels and carrier generation rates of 10 to the 24th/cu cm per sec. Carrier concentration increases at high illuminance led to bandgap narrowing, resulting in a decrease in the open-circuit voltage with increases in the illumination level. M S K

A83-27979**COMPUTER SIMULATION OF THE OPTICAL BEHAVIOUR OF AMORPHOUS SILICON SOLAR CELLS**

W DEN BOER and R. M. VAN STRIJP (Delft, Technische Hogeschool, Delft, Netherlands) Solar Cells, vol 8, Mar 1983, p. 169-178. Research supported by the Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek refs

Computer simulations were employed to study the optical behavior of thin film solar cells. Consideration was given to a-Si:H cells with highly reflective back contacts and Schottky barriers. It was found that multiple reflections and interference effects are effective with long wavelength light and improve cell efficiency. Cell thicknesses were identified at which relative maximal integrated absorptions occur at AM1. An optimum antireflection coating formulation is developed for an arbitrary cell. Interference effects were shown to produce periodic variations in the electron-hole pair generation rate for weakly absorbed monochromatic radiation. The computer model is concluded to be applicable of p-i-n cells, tandem cells, and multijunction cells. M S K

02 SOLAR ENERGY

A83-27981

GRAIN BOUNDARY EFFECTS IN POLYCRYSTALLINE SILICON SOLAR CELLS. I - SOLUTION OF THE THREE-DIMENSIONAL DIFFUSION EQUATION BY THE GREEN'S FUNCTION METHOD. II - NUMERICAL CALCULATION OF THE LIMITING PARAMETERS AND MAXIMUM EFFICIENCY

N C HALDER and T R WILLIAMS (South Florida, University, Tampa, FL) Solar Cells, vol 8, Apr 1983, p. 201-223, 225-238 refs

A theoretical model is developed for the photocurrent, the dark current, and the fill factor for an n-p junction fibrously grained polycrystalline Si solar cell. Six boundary conditions are defined in order to use Green's function to obtain a solution to the three-dimensional diffusion equation. The recombination velocity is assumed to be equal at all points on the boundaries and the density change is modeled as occurring at the boundaries the same as it does on the surfaces of the cell. The hole current densities in the n and p regions are quantified. The analysis is concluded useful for polycrystalline Si materials with a fibrously oriented grain structure. It is suggested that the fibrously oriented grains, which give a higher current flow than random grain structure, can be implemented with thin film material in ribbon or cast ingot form. MSK

A83-27982

DIFFUSION LENGTH DETERMINATION IN N/+/-P-P/+/- STRUCTURE BASED SILICON SOLAR CELLS FROM THE INTENSITY DEPENDENCE OF THE SHORT-CIRCUIT CURRENT FOR ILLUMINATION FROM THE P/+/- SIDE

G. C JAIN, S N SINGH, and R K KOTNALA (National Physical Laboratory of India, New Delhi, India) Solar Cells, vol. 8, Apr 1983, p. 239-248 refs

A technique for measuring the diffusion length (L) of minority carriers in Si solar cells with base regions that feature a high-low junction at one end and a p-n junction at the other is presented. The p(+)-p-n(+) or n(+)-p-p(+) cell is illuminated by monochromatic light from the p(+) side and the short circuit current is measured as a function of the light intensity. The slope of the current in relation to the intensity is proportional to the ratio of the thickness of the cell (d) to L. The relationship is quantified and applied to the results of tests with Si cells with bifacial symmetry, cut from Czochralski-grown crystals. L is obtained directly, and the method is concluded to be applicable in cases where d/L is at least 0.6. MSK

A83-27983

DESIGN OF ANTIREFLECTION COATINGS FOR TEXTURED SILICON SOLAR CELLS

B L SOPORI and R A PRYOR (Motorola, Inc., Phoenix, AZ) Solar Cells, vol 8, Apr 1983, p. 249-261 refs

In this paper the design of a thin film coating to optimize the performance of a textured silicon solar cell is described. A ray optics approach is used to determine the reflection characteristics of textured cells with a two-layer thin film coating. A generalized expression for the external quantum efficiency in terms of the given internal quantum efficiency and the coating parameters is determined. The parameters of the thin film layers, the refractive indices and the thicknesses are determined so as to maximize the integrated cell response to an air mass 2 spectrum. (Author)

A83-27984

REACTIVE SPUTTERED TA2O5 ANTIREFLECTION COATINGS

F. RUBIO (Escuela de Ingenieros Industriales, San Sebastian, Spain), J DENIS, J M. ALBELLA, and J M MARTINEZ-DUART (Consejo Superior de Investigaciones Cientificas, Departamento Fisica Aplicada y Instituto Fisica del Estado Solido, Madrid, Spain) Solar Cells, vol 8, Apr. 1983, p. 263-268. refs

The optical properties of Ta2O5 films formed from magnetron reactive sputtering (MRS) are described and their applicability as AR coatings on solar cells is discussed. The sputtering is performed in an Ar and O2 atmosphere to form the AR coating without heating the substrate. The film thickness is controlled to an accuracy of 1 percent with a thickness of 3600 Å and considering

instrument error, 2 percent overall. The absorption coefficient of the film is shown to be low in the visible and to increase rapidly above 4 eV, due to electronic transitions across the Ta2O5 energy gap. An optimized index of refraction of 2.01 is attained. Sputter deposition of the film onto an 18 sq cm Si cell during trials raised the cell efficiency from 9.5 percent to 12.9 percent, while the fill factor remained constant. M.S.K

A83-27986

THE FILL FACTOR OF A SOLAR CELL FROM A MATHEMATICAL POINT OF VIEW

A DE VOS (Gent, Rijksuniversiteit, Ghent, Belgium) Solar Cells, vol. 8, Apr. 1983, p. 283-296. refs

Analytical methods for calculating the fill factor of a solar cell are examined. Attention is given to an ideal cell and to data from a real cell, and an attempt is made to relate the fill factor and the input explicitly. The parameter representation method and the asymptotic expansion method are employed to calculate the fill factor while showing series and shunt losses by accounting for a large open-circuit voltage, a small series resistance, and a large resistance. M S K

A83-28366

A METHOD FOR PRODUCING HEAT PIPES FOR COOLING SEMICONDUCTOR PHOTOVOLTAIC CELLS AND THE HEAT PIPE CHARACTERISTICS [SPOSOB POLUCHENIIA I KHARAKTERISTIKI TEPOVYKH TRUB DLIA OKHLAZHDENIIA POLUPROVODNIKOVYKH FOTOELEKTRICHESKIKH PREOBRAZOVATELEI]

A S KOSTYGOV, B N KORCHUNOV, V V PELLER, V IU. FEDOROV, G G KHOKHLOV, A A KOLCHINA, KH K ARIPOV, and V D RUMIANTSEV (Akademii Nauk SSSR, Fiziko-Tekhnicheskii Institut, Leningrad, USSR) (Soveshchanie po Polucheniiu Profilirovannykh Kristallov i Izdelii Sposobom Stepanova i ikh Primeneniiu v Narodnom Khoziaistve, Leningrad, USSR, Mar. 10-12, 1982.) Akademii Nauk SSSR, Izvestiia, Seria Fizicheskaya, vol 47, Feb. 1983, p. 399-402. In Russian. refs

Semiconductor photovoltaic cells based on GaAs-Al-GaAs structures can be efficiently cooled in self-contained solar power plants by using low-temperature heat pipes. Here, a method for fabricating finned heat pipes of AMTs aluminum alloy is proposed whereby the pipe is continuously pulled from molten metal by Stepanov's technique. The temperature of the melt is maintained at 710-712 C throughout the process, and the pulled pipe is cooled by air blown by a compressor at 3.65 cu m/hr, the average pulling rate is 36 mm/min. Methods for testing the heat pipes and for calculating their thermal characteristics are discussed. V L

A83-28647#

THE DESIGN AND CONSTRUCTION OF A LOW POWER GAS TURBINE FOR SOLAR ENERGY CONVERSION - AN ANALYTICAL MODEL OF OPERATION OF THE INSTALLATION IN A VARIABLE MODE [CONCEPTION ET REALISATION D'UNE TURBINE A GAZ DE FAIBLE PUISSANCE DESTINEE A LA CONVERSION DE L'ENERGIE SOLAIRE - MODELISATION DU FONCTIONNEMENT DE L'INSTALLATION EN REGIME VARIABLE]

J. F. LEONE (Lyon, Institut National des Sciences Appliquees, Docteur-Ingenieur Thesis, 1982 183 p. In French. refs

A thermodynamic analysis of a Brayton cycle engine used for the conversion of solar thermal energy to electricity is presented and compared with experimental results. The power configuration is a parabolic concentrator with the engine placed at the focus. Its benefits are a minimal visual impact, modular construction, rapid start-up, simple site planning, and flexibility as to end use. Consideration is given to a generator powered by hot air and mounted in series with other modules, and to heating elements mounted in parallel. A numerical model accounts for system losses, and application is demonstrated with a system producing 2.5 kWe at 800 C, i.e., a 45 kWt output. A second model is devised to describe the isentropic efficiencies which can be expected during variable speed operations. Finally costs of the power plant are compared with costs of conventionally fueled facilities. M S K

A83-28652#

A STUDY OF A SOLAR CENTRAL POWER PLANT WITH A GAS TURBINE - PROJECT SIROCCO MODELLING AND CONTROL [CONTRIBUTION A L'ETUDE D'UNE CENTRALE SOLAIRE A TURBINE A GAZ - MODELISATION ET COMMANDE 'PROJECT SIROCCO']

M. KACIM Toulouse III, Université, Docteur (3e cycle) Thesis, 1982 114 p. In French. refs

A thermodynamics and receiver design analysis is presented for a solar tower power plant, together with a control model for operations in varying working conditions. The analysis covers the central receiver and the gas-air turbine, adapted for functioning at 820 C, such as was experienced with the 100 kW Project Sirocco test station. A heliostat field concentrates solar energy onto a central receiver traversed by compressed air, which is allowed to expand while driving a turbine generator. A combustion chamber is included in the loop to augment the thermal performance when insufficient solar energy is available. The plant can be either grid-connected or stand alone. Static and dynamic characteristics of the thermal loop are modelled, and are included in the development of control laws based on quadratic criteria. An optimized control scheme is devised which features weighting criteria matrices, and the results of simulations covering different insolation levels are reported. Finally, an adjoint state control system is produced to account for peculiarities of the power plant. M.S.K.

A83-28653#

CONCENTRATOR SYSTEMS IN PHOTOVOLTAIC CONVERSION - ASSESSMENT AND PERSPECTIVES [LES SYSTEMES A CONCENTRATION DANS LA CONVERSION PHOTOVOLTAIQUE - BILAN ET PERSPECTIVES]

B. LAURENT Toulouse III, Université, Docteur-Ingenieur Thesis, 1982. 183 p. In French. refs

The various methods and machinery used in concentrator photovoltaic systems are reviewed, with particular note made of configurations and their economics as tested in the French Sophocle program. A series of prototypes were installed to test systems of 100 W in various climates, and one pumping installation generating 500 W was constructed. Monitoring was carried out on the thermal, electrical, and physical evolution of the cells and the relations between the climatic and operational parameters. Emphasis was laid on Si cells, their efficiency, the thermal resistance to cooling, output as a function of temperature, thermal radiator performance, and defect analysis. Although the concentrator mode reduces the cell cost, it also increases the cost of the total assembly and complicates the production process. Further studies to lessen humidity intrusion, lower the cell cooler assembly weight, and define markets for concentrator systems are indicated. M.S.K.

A83-28938

A PROBABILITY DENSITY FUNCTION FOR THE CLEARNESS INDEX, WITH APPLICATIONS

K G T HOLLANDS and R.G. HUGET (Waterloo, University, Waterloo, Ontario, Canada) Solar Energy (ISSN 0038-092X), vol. 30, no. 3, 1983, p. 195-209. Research supported by the Natural Sciences and Engineering Research Council of Canada. refs

A universal generalized probability density function (PDF) for predicting solar insolation at a given location where historical data is available is presented and compared to the formulation of Bendt et al (1981). The PDF is defined in terms of a Gamma function involving the hourly clearness index upper bound and the average atmospheric transmissivity at the specific location. A PDF is also developed for the diffuse fraction as a function of the long-term diffuse fraction data. Finally, a general purpose integral equation is formulated and used in sample calculations for the output of flat plate and concentrating collectors, the net energy gain through windows, and the total irradiation on an inclined surface. Inaccuracies in the predictions, when compared with performance and in situ data, are used to indicate the areas for further analytical development. M.S.K.

A83-28939

HEAT LOSS COEFFICIENTS AND EFFECTIVE TAU-ALPHA PRODUCTS FOR FLAT-PLATE COLLECTORS WITH DIATHERMANOUS COVERS

K G T. HOLLANDS (Waterloo, University, Waterloo, Ontario, Canada) and J. L. WRIGHT (Spider Engineering Associates, Inc., Waterloo, Ontario, Canada) Solar Energy (ISSN 0038-092X), vol. 30, no. 3, 1983, p. 211-216 refs

This paper presents an efficient algorithm for solving the set of nonlinear equations governing the total heat transfer across an arbitrary number of parallel flat plate solar collector covers, each of which can be partly transparent to longwave thermal radiation. The governing equations are sufficiently general to permit each cover to have asymmetric radiative properties and to account for absorption of solar energy on the individual covers. This theory is shown to be in good agreement with the approximate equations of Whillier (provided certain interpretations are placed on his quantities) and with experiments using a plastic inner cover and bounding plates of various emissivities. Using this theory, it is demonstrated that if the absorber plate has a selective surface, an inner cover transparent to long wave radiation is to be preferred over one which is opaque. Author

A83-28940

THE MULTIPLE LAYER SOLAR COLLECTOR

J P KENNA (University College, Cardiff, Wales) Solar Energy (ISSN 0038-092X), vol. 30, no. 3, 1983, p. 225-235. refs

An analytical model is developed for obtaining numerical solutions for differential equations describing the performance of separate layers in a multiple layer solar collector. The configurations comprises heat transfer fluid entering at the top of the collector and travelling down through several layers. A black absorber plate prevents reemission of thermal radiation. The overall performance is shown to depend on the number of layers, the heat transfer coefficient across each layer, and the absorption properties of the working fluid. It is found that the multiple layer system has a performance inferior to that of flat plate selective surface collectors. Air gaps insulating adjacent layers do not raise the efficiency enough to overcome the relative deficiency. M.S.K.

A83-28942

HIGH TEMPERATURE DEGRADATION IN COBALT OXIDE SELECTIVE ABSORBER

C. CHOUDHURY and H. K. SEHGAL (Indian Institute of Technology, New Delhi, India) Solar Energy (ISSN 0038-092X), vol. 30, no. 3, 1983, p. 291, 292 refs

The results of stability studies of cobalt oxide coatings for selective surfaces in solar thermal collectors are presented. Pyrolyzed solutions of $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ were deposited on heated aluminum and galvanized iron, then subjected to four hourly cycles of heating and cooling. Up to 650 C was used for the aluminum surface and 400 C for the iron, followed by fast cooling for both. Auger electron spectroscopic, spectrophotometric, and emission studies were performed. The cobalt oxide films maintained their absorbance and emittance levels on both surfaces provided that heating did not surpass 550 C for aluminum and 350 C for iron. Elemental diffusion processes degraded performance at higher temperatures. M.S.K.

A83-29039

A 2D MODEL OF TURBULENT SOLAR INDUCED FLOWS IN PASSIVE AIR COLLECTORS

O A. BARRA, J-M. BUCHLIN (Calabria, Università Cosenza, Italy), and E. P. CARRATELLI (Institut von Karman de Dynamique des Fluides, Rhode-St-Genese, Belgium) Nuovo Cimento B, Serie 11, vol. 73B, Jan. 11, 1983, p. 1-14. Research supported by the Consiglio Nazionale delle Ricerche. refs

The use of a complete parabolic model of heat and mass transfer in a transparent plate solar collector has confirmed previous results on the importance of heat losses in the ducts and has shown the risk of flow inversions. A parabolic flow assumption is made and a computer model is employed by numerically solving the relevant momentum, continuity, and internal

02 SOLAR ENERGY

energy equations. Turbulence is modelled by introducing two more equations: turbulent kinetic energy and turbulent dissipation rate. Different hypotheses on external convective heat losses are also tested. The role of turbulence in increasing efficiency and in avoiding recirculation is shown to be very important. C.D.

A83-29407

REDOX ION FLOW CELL FOR SOLAR ENERGY STORAGE

H. CNOBLOCH, W. KELLERMANN, H. NISCHIK, K. PANTEL, and G. SIEMSEN (Siemens AG, Forschungslaboratorien, Erlangen, West Germany). Siemens Forschungs- und Entwicklungsberichte (ISSN 0370-9736), vol. 12, no. 2, 1983, p. 79-84. refs

Redox cells which can be used as a storage system with solar cell or wind powered electrical generating plants are explored. Fluid reaction partners are a means to provide reversible processes that can withstand long-term cycling and still be economical. A redox cell stores energy in the form of solutions of metal ion pairs at different oxidation states, such as $\text{Fe}^{3+}/\text{Fe}^{2+}$ and $\text{Cr}^{2+}/\text{Cr}^{3+}$ ions. Bringing the ions into reaction at two different electrodes separated by a membrane produces a current through an ion exchange. Tests have been performed with the Fe-Cr configuration, using Pt, glassy carbon, and Durabon electrodes. The charge-discharge characteristics were satisfactory, although further development is necessary to increase the durability of redox cells, i.e., the capacity to continually recycle while maintaining efficiency. Author

A83-29512

PROPERTIES OF OXIDIZED COPPER SURFACES FOR SOLAR APPLICATIONS. I

A. ROOS, T. CHIBUYE, and B. KARLSSON (Uppsala, Universitet, Uppsala, Sweden). Solar Energy Materials (ISSN 0165-1633), vol. 7, Jan-Feb. 1983, p. 453-465. refs

The solar selective properties of oxidized copper have been studied. Three different oxidation processes were performed and the surface layers obtained were characterized using optical reflectance measurements, X-ray diffraction and SEM. The oxide layers were formed using dry thermal oxidation, chlorite chemical bath and Ebanol C chemical bath. The results show that the thermal oxidation cannot produce surfaces of significant solar selectivity neither for high oxidation temperatures nor for long oxidation times, while, on the other hand, the chemical methods give surface layer with high solar absorptance and low thermal emittance. Since no significant difference in surface composition has been detected it is concluded that the difference between chemically and thermally produced surfaces is due to surface morphology. Author

A83-29513

PROPERTIES OF OXIDIZED COPPER SURFACES FOR SOLAR APPLICATIONS. II

A. ROOS and B. KARLSSON (Uppsala, Universitet, Uppsala, Sweden). Solar Energy Materials (ISSN 0165-1633), vol. 7, Jan-Feb. 1983, p. 467-480. refs

The optical constants of CuO and Cu_2O have been measured and the possibility of preparing selective surfaces based on these on copper has been investigated. Theoretical and experimental reflectance curves are compared, and it is shown that oxides obtained by thermal oxidation have the reflectance characteristics predicted by theory. Chemically oxidized copper, however, differ considerably from the predicted behavior. The analyses of the oxide metal tandem and the air-oxide and oxide-metal interfaces show that the morphology of these interfaces to a large extent determines the selective properties of these tandems. Author

A83-29514

FACTORS AFFECTING THE EFFICIENCY OF CHEMICALLY DEPOSITED CDSE BASED PHOTOELECTROCHEMICAL CELLS

R. C. KAINTHLA, J. F. MCCANN, and D. HANEMAN (New South Wales, University, Kensington, Australia). Solar Energy Materials (ISSN 0165-1633), vol. 7, Jan-Feb. 1983, p. 491-500. Research supported by the National Energy Research Development and Demonstration Council and Australian Research Grants Committee. refs

CdSe thin films have been deposited on titanium, nickel and stainless steel substrates by a chemical deposition technique from an aqueous solution of cadmium acetate, ammonia and sodium selenosulfate. The effects of film thickness, substrates and annealing temperature in air on the performance of CdSe based photoelectrochemical cells have been studied. Open-circuit voltages up to 728 mV have been obtained for film deposited on nickel substrates. By optimising deposition and post deposition conditions, for Ni and Ti substrates efficiencies up to 5.5 percent have been obtained on small (1 sq cm) cells. Author

A83-29704

VELOCITY MEASUREMENTS IN AN AXISYMMETRIC LAMINAR FLOW USING AN OPTICAL TECHNIQUE OF VISUALIZATION IN COHERENT LIGHT [MESURES DE VITESSES DANS UN ECOULEMENT LAMINAIRE AXISYMETRIQUE PAR UNE TECHNIQUE OPTIQUE DE VISUALISATION EN LUMIERE COHERENTE]

C. PHILIPPE (Poitiers, Universite, Poitiers, France) and C. FROEHLI (Limoges, Universite, Limoges, France). Zeitschrift fuer angewandte Mathematik und Physik (ISSN 0044-2275), vol. 34, March 1983, p. 137-153. In French. refs

A holographic method is presented for visualization of the velocity distribution inside a laminar flow of a transparent liquid. A double pulsed ruby laser illuminates a suspension of micron sized particles, i.e., the impurities present in any flow. The images produced by the double pulses are integrated on a plate, thus producing the interference patterns between the fields scattered by particulates and the two reference fields. The displacement of the scatterers during the time of illumination can be measured when viewed under a microscope. The method was tested in a flow through a transparent cylindrical tube and the flow of a free jet. Good accuracy was demonstrated, and it is noted that recording the image on a photographic plate bypasses the image accuracy dependence on the quality of optics used. M.S.K.

A83-29896

THE LOSS OF POWER SUPPLY PROBABILITY AS A TECHNIQUE FOR DESIGNING STAND-ALONE SOLAR ELECTRICAL (PHOTOVOLTAIC) SYSTEMS

E. OFRY and A. BRAUNSTEIN (Tel Aviv University, Tel Aviv, Israel). (Institute of Electrical and Electronics Engineers, Summer Meeting, San Francisco, CA, July 18-23, 1982). IEEE Transactions on Power Apparatus and Systems (ISSN 0018-9510), vol. PAS-102, May 1983, p. 1171-1175. refs

It is noted that most of the analysis and design methods used in solar electrical systems (SESSs) are based on the concept of power supply during a number of autonomous days (NAD). The NAD value is the number of consecutive days on which no power is supplied to the system from the solar cell array (SCA). The storage system capacity is therefore based on the required energy during NAD. In view of the high costs of solar cells and storage batteries, a system may not operate at its optimum with the NAD method. A new method for analyzing and designing SESSs is presented which makes it possible to determine the minimum (and thus the economical) sizes of the SCA and storage system capacity. The reliability of the system is assessed using the 'loss of power supply' probability concept. Results from an SES designed in accordance with this method and in operation for more than two years are cited as validation for the method. C.R.

N83-29946#

OPTIMIZATION OF PULLING CONDITIONS BY ELECTRONIC BOMBARDMENT OF POLYCRYSTALLINE SILICON RIBBONS FOR SOLAR CELLS [OPTIMISATION DES CONDITIONS DE TIRAGE PAR BOMBARDEMENT ELECTRONIQUE DE RUBANS DE SILICIUM POLYCRISTALLIN POUR PHOTOPILES SOLAIRES]

L VANDEKERKOVE Lyon, Ecole Centrale, Docteur-Ingenieur Thesis, 1982, 145 p In French refs

A manufacturing process for the production of ribbon polycrystalline solar cells by electron gun bombardment of Si powder is described. The molten zone created is deflected onto compacted material and the process becomes self-sustaining. Electron bombardment of the preribbon that forms brings it to full crystallization. The process is monitored by an optical pyrometer, video camera, a micrometer displacement table, and thermography to detect thermal gradients. An IR photoelasticimeter permits measurement of the residual stresses in relation to the drawing conditions. The system produces a ribbon 2 cm wide, several centimeters long, and 300 microns thick with a columnar structure. A diffusion length of 10 microns was found by scanning electron microscope inspection. Efficiencies of up to 8 percent are projected with medium grade purity Si powders. M S K

N83-16688# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment

OPTIMAL HEAT PUMPS FOR SOLAR-ASSISTED HEAT-PUMP SYSTEMS

M A. CATAN 1981 7 p refs Presented at the Intern Solar Energy Soc Solar World Forum, Brighton, England, 23-28 Aug 1981

(Contract DE-AC02-76CH-00016)

(DE82-004798, BNL-30140; CONF-810865-5) Avail NTIS HC A02/MF A01

Work at Brookhaven National Laboratory (BNL) investigates the design of optimal heat pumps for solar assisted heat pump (SAHP) systems. Heat pump designs suitable for two generic systems, identified in the course of recent analytical work, are being studied. These are series SAHP systems operating at evaporator temperatures in the -5 to 10 C range and those operating at evaporator temperatures in the 10 to 35 C range. A heat pump simulator has been constructed with liquid based source subsystem and two load subsystems, one for testing air cooled condensers and one for testing water cooled condensers. Heat pumps tested were composed of various components including several types of variable and fixed capacity compressors, two types of expansion devices, and heat exchangers varying in size and type. DOE

N83-16710# United Technologies Corp., East Hartford, Conn
SOLAR/GAS RANKINE/RANKINE-CYCLE HEAT PUMP ASSESSMENT Final Report, Mar. 1981 - Jul. 1982

H E KHALIFA and G MELIKIAN Jul. 1982 208 p refs

(Contract GRI-5080-343-0441)

(PB82-254863, UTRC-R82-955621, GRI-80/0139) Avail: NTIS HC A10/MF A01 CSCL 13A

This report contains an assessment of the technical and economic feasibility of Rankine-cycle solar-augmented gas-fired heat pumps (SAGFHP) for multi-family residential and light-commercial applications. The SAGFHP design considered in this report is based on the successful UTRC turbocompressor system which has been tested both in the laboratory and in a solar cooling installation in Phoenix, AZ. An hour-by-hour modeling of present-design SAGFHP performance in multi-family and office buildings in New York, Wisconsin, Nebraska and Oregon indicated that, even without solar augmentation, primary energy savings of up to 17% and 31% could be achieved relative to advanced furnace plus electric air conditioning systems and electric heat pumps, respectively. GRA

N83-16871# Solarex Corp., Rockville, Md.

DESIGN AND FABRICATION OF A PROTOTYPE SYSTEM FOR A PHOTOVOLTAIC RESIDENCE IN THE NORTHEAST

Aug 1982 87 p refs Prepared in cooperation with Mueller Associates, Inc., Baltimore and Price and Partners, Takoma Park, Md. Prepared for Lincoln Lab., MIT, Lexington, Mass

(Contract DE-AC02-76ET-20279)

(DE82-022497, DOE/ET-20279-224) Avail NTIS HC A05/MF A01

This project consisted of the design, fabrication, and testing of a photovoltaic residence which is suitable for construction in the Northeast. A full size residence was designed which included energy conserving and passive features, and the energy performance of the residence was completed for a 5 kW PV array in a standoff configuration. Actual construction consisted of the roof structure and a building enclosure large enough to contain the PCU, test equipment, and load simulation equipment. The PV array consists of 78 modules along with a line tie inverter. DOE

N83-16872# Westinghouse Electric Corp., Pittsburgh, Pa
Advanced Energy Systems Div

DESIGN AND FABRICATION OF A PROTOTYPE SYSTEM FOR PHOTOVOLTAIC RESIDENCES IN THE NORTHEAST Final Report

P F PITTMAN and R T DRESSLER Jun. 1982 115 p

(Contract DE-AC02-76ET-20279)

(DE82-022210, DOE/ET-20279/199) Avail NTIS HC A06/MF A01

A single family residence including a solar photovoltaic power system was designed for the Northeast. The residence utilizes passive solar and energy conservation techniques to minimize the annual electrical load. A prototype of the electrical system was constructed and maintained for one year. The array is integrally mounted using a new panel installation concept, and produces 5.7-kW peak at standard test conditions (100 mW/cm², 280C, Am 1.5). The system is interactive with the utility and uses a voltage fed, self commutated power conditioner. The system operates automatically turning on and off as the sun rises and sets. DOE

N83-16873# Lincoln Lab., Mass Inst of Tech., Lexington.
SOLAR-PHOTOVOLTAIC POWER FOR BROADCASTING STATIONS: AN ECONOMIC ANALYSIS

B E NICHOLS and M T KATZMAN Aug 1982 51 p refs

(Contract DE-AC02-76ET-20279)

(DE82-022498, DOE/ET-20279/223) Avail: NTIS HC A04/MF A01

An economic analysis of the profitability for broadcasting stations of replacing conventional electricity with on-site solar photovoltaic power systems was undertaken. Technological characteristics of these power systems are presented along with the economic assumptions necessary for their evaluation. Time of initial profitability, time of optimal investment, optimum system capacity, and impact of tax incentives on profitability are analyzed for several locations in the country representative of the range of insolation conditions. The analyses indicate that photovoltaic power systems are expected, if cost predictions are met, to prove profitable for the broadcasting market in the Southwest by the early 1980s, in the South by the mid-1980s and in the Northeast by the late 1980s. The study was performed in 1979 and was used to help design an experimental PV power system for a radio station in Ohio, which was installed in that year and is operating successfully. DOE

02 SOLAR ENERGY

N83-16877# Brookhaven National Lab, Upton, N Y Solar Technology Group.

FLAT-PLATE SOLAR COLLECTORS UTILIZING POLYMERIC FILM FOR HIGH PERFORMANCE AND VERY LOW COST

W G WILHELM 1981 8 p refs Presented at the Intern Solar Energy Soc. Solar World Forum, Brighton, England, 23-28 Aug 1981

(Contract DE-AC02-76CH-00016)

(DE82-004797, BNL-30148, CONF-810865-6) Avail NTIS HC A02/MF A01

Polymeric films are used in the construction of the absorber and window portions of a flat plate solar collector. The absorber heat exchanger consists of a channeled liquid envelope constructed using a polymeric film and metal foil laminate. In addition, the composite films and light frame monocoque construction contribute to very light weight and low cost. The use of high-performance polymers permits low-loss designs with high thermal performance. The construction concepts are consistent with high speed mass production and installation with manufacturing cost projections of \$15 or 2 square meters. Tests indicate performance potential consistent with applications incorporating solar absorption air conditioning. DOE

N83-16878# Sandia Labs, Albuquerque, N. Mex. VARIATION IN THE MICROSTRUCTURE OF ELECTRODEPOSITED BLACK CHROME SOLAR COATINGS

R B PETTIT, J N SWEET, and R SOWELL 1982 36 p refs Presented at the MiCon Symp., Houston, Tex., 18 Jan 1982

(Contract DE-AC04-76D-00789)

(DE81-030842, SAND-81-0293C, CONF-820102-1) Avail NTIS HC A03/MF A01

Electrodeposited black chrome solar coatings were found to thermally degrade when used at temperatures near 300 C. This degradation is evidenced by a large decrease in the solar absorptance for these coatings. A detailed study is done of the dependence of the coating microstructure and composition on the plating process variables and how these film properties change after thermal aging. A model was developed of the black chrome coating. This model is used to calculate the reflectance properties as a function of the average Cr_2O_3 vol % within the film. The calculated reflectance curves are compared to experimental data for coatings aged for various times at 450 C in air. Both model and experiment show that the solar absorptance initially decreases only slowly as the amount of Cr_2O_3 increases, however, a rapid decrease occurs when the Cr_2O_3 content passes 70 vol %. DOE

N83-16879# Brookhaven National Lab, Upton, N. Y. THERMAL PERFORMANCE OF THE BROOKHAVEN NATURAL THERMAL STORAGE HOUSE

H T GHAFARI and R F JONES 1981 12 p refs Presented at the Solar World Forum, Brighton, England, 23-28 Aug 1981

(Contract DE-AC02-76CH-00016)

(DE82-005507, BNL-30268, CONF-810865-8) Avail NTIS HC A02/MF A01

In the Brookhaven natural thermal storage house, an energy-efficient envelope, passive solar collectors, and a variety of energy conservation methods are incorporated. The thermal characteristics of the house during the tested heating season are evaluated. Temperature distributions at different zones are displayed, and the effects of extending heating supply ducts only to the main floor and heating return ducts only from the second floor are discussed. The thermal retrievals from the structure and the passive collectors are assessed, and the total conservation and passive solar contributions are outlined. Several correlation factors relating these thermal behaviors are introduced, and their diurnal variations are displayed. Finally, the annual energy requirements, and the average load factors are analyzed and discussed. DOE

N83-16881# Midwest Research Inst, Golden, Colo Photovoltaics Div

INFLUENCE OF GRAIN BOUNDARIES ON SOLAR CELL PERFORMANCE

J. B. MILSTEIN, Y S TSUO, R W HARDY, and T SUREK May 1981 7 p refs Presented at the 15th IEEE Photovoltaic Spec. Conf., Orlando, Fla., 12-15 May 1981

(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)

(DE82-004662, SERI/TP-614-1219, CONF-810526-40) Avail NTIS HC A02/MF A01

For abstract see A82-45133

N83-16882# Sandia Labs, Albuquerque, N. Mex Photovoltaic Systems Development Div.

GAME-THEORY APPROACH TO CONSUMER INCENTIVES FOR SOLAR ENERGY

J. K. SHARP Nov 1981 12 p refs

(Contract DE-AC04-76DP-00789)

(DE82-004501, SAND-81-1618) Avail NTIS HC A02/MF A01

Solar energy is currently not competitive with fossil fuels. Fossil fuel price increases may eventually allow solar to compete, but incentives can change the relative price between fossil fuel and solar energy, and make solar compete sooner. Examples are developed of a new type of competitive game using solar energy incentives. Competitive games must have players with individual controls and conflicting objectives, but recent work also includes incentives offered by one of the players to the others. In the incentive game presented here, the Government acts as the leader and offers incentives to consumers, who act as followers. The Government incentives offered in this leader-follower (Stackelberg) game reduce the cost of solar energy to the consumer. Both the Government and consumers define their own objectives with the Government determining an incentive (either in the form of a subsidy or tax) that satisfies its objective. The two hypothetical examples developed show how the Government can achieve a stated utilization rate with the proper incentives. DOE

N83-16888# Los Alamos Scientific Lab, N. Mex. ANNUAL THERMAL PERFORMANCE OF SUNSPACE-TYPE PASSIVE-SOLAR COLLECTORS FOR RESIDENCE HEATING: ATTACHED AND SEMI-ENCLOSED GEOMETRIES

R D MCFARLAND, R W JONES, and G. S. LAZARUS Sep 1982 79 p refs

(Contract W-7405-ENG-36)

(DE83-002310, LA-9424-MS) Avail NTIS HC A05/MF A01

The sunspace which is an important category of passive solar system for heating small and moderate sized building was analyzed. There is a wide variety of possible geometries of sunspaces, and a few of these were analyzed to obtain simplified annual performance estimation equations in the form of solar load ratio correlations. The details and correlations of all of the configurations analyzed are summarized. Author

N83-16889# Vitro Labs., Silver Spring, Md Solar System Analysis Group

COMPARATIVE REPORT: PERFORMANCE OF SOLAR HOT-WATER SYSTEMS, 1980 - 1981

M A CRAMER, J W. SPEARS, and E O. POLLOCK 1982 202 p refs

(Contract DE-AC01-79CS-30027)

(DE83-000069, SOLAR/0024-82/41) Avail NTIS HC A10/MF A01

Data are provided on 42 solar water heater sites in the National Solar Data Network. Individual site parameters are tabulated such as collector areas, storage tank sizes, manufacturers, collector fluids, etc. Hot water heating data for 1980 to 1981 are tabulated and summarized, and analysis results are graphed to highlight key summary information. Observations on the performance of the systems are summarized with discussions of specific cases and conclusions which may be drawn. Specific detailed data and information necessary to support the development of results presented are appended. DOE

**N83-16890# Vitro Labs, Silver Spring, Md
RYMARK 1, RYMARK 2, AND RYMARK 3, FREDERICK,
MARYLAND: SOLAR-ENERGY-SYSTEM PERFORMANCE
EVALUATION, MAY 1981 THROUGH MARCH 1982**

J W SPEARS 1982 125 p refs
(Contract DE-AC01-79CS-30027)
(DE83-000067; SOLAR/1106-82/14, SOLAR/1110-82/14;
SOLAR/1107-82/14) Avail NTIS HC A06/MF A01

Sites of single family Maryland residences whose respective passive solar energy systems are designed to supply 16%, 28%, and 42% of their heating loads were examined. Each is equipped with a 24,000-Btu heat pump for auxiliary heating. Rymark 1 is equipped with 92 square feet of south facing double glazed windows. Rymark 2 is equipped with 150 square feet of south facing triple panel windows. Rymark 3 is equipped with 227 square feet of south facing triple pane windows with blinds and 560 square feet of phase change ceiling tile system. Monthly performance data are tabulated and compared for the overall system of each house, and for the collector, space heating, and storage subsystem. For each house and for each month, the insolation, ambient air and building temperature, and auxiliary energy used are graphed vs. day of the month. These data are also graphed vs. hour of the day for a typical day. Monthly data are also tabulated for the environment in the passive systems, energy savings, and weather conditions. DOE

**N83-16894# Vitro Labs, Silver Spring, Md.
CONTEMPORARY SYSTEMS, INC., WALPOLE, NEW
HAMPSHIRE SOLAR-ENERGY-SYSTEM PERFORMANCE
EVALUATION Progress Report, Oct. 1981 - Apr. 1982**

B D HOWARD 1982 97 p refs
(Contract DE-AC01-79CS-30027)
(DE83-000068, SOLAR-2116-82/14) Avail NTIS HC A05/MF A01

A hybrid solar building in New Hampshire designed to obtain 71% of its space heating and 75% of its water heating from solar energy was evaluated. The active solar system is equipped with 800 square feet of flat plate air collectors and two site built rock bins. There is also a window wall and sunspace. Auxiliary water heating is electric. Monthly performance data are tabulated for the solar system overall, for the active and passive collector systems, water and space heating subsystems, and the building. Monthly data for the solar coefficients of performance, building environment, solar operating energy, energy savings, and weather conditions are also tabulated. Typical system operation is illustrated by graphs for a typical day of the hourly temperatures at different parts of the system, active heating system fluid flow rate, and total insolation. Typical system operating sequences are also graphed, as well as the solar energy use. DOE

**N83-16895# Vitro Labs, Silver Spring, Md.
GILL HARROP, BIG FLATS, NEW YORK
SOLAR-ENERGY-SYSTEM PERFORMANCE EVALUATION
Progress Report, Nov. 1980 - Apr. 1982**

B D HOWARD 1982 97 p refs
(Contract DE-AC01-79CS-30027)
(DE83-000065, SOLAR-1096-82/14) Avail: NTIS HC A05/MF A01

The Gill Harrop site is a single family residence located in New York with a passive solar energy system designed to supply 75% of the heating load. The system is equipped with 403 square feet of windows, including 98 square feet of clerestory windows, an R-3.4 window quilt on all glazing, an 80,400 pound insulated concrete floor slab and two mass walls totalling 95,240 pounds, and electric baseboard auxiliary heaters of 9.5 kW total capacity. Monthly performance data are tabulated for the overall system and for the collector, storage, and space heating subsystems and for the environment in the passive system, energy savings, and weather conditions. Graphs for each month of the auxiliary energy used, ambient, storage, and building temperatures, and insolation vs. day of the month are presented. These data are also graphed for a typical day. DOE

**N83-16896# Boeing Computer Services, Inc., Seattle, Wash
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION
EXPERIMENT OPERATIONAL PERFORMANCE REPORT FOR
LOVINGTON SQUARE SHOPPING CENTER, LOVINGTON, NEW
MEXICO**

Sep 1982 27 p Prepared for Sandia Labs
(Contract DE-AC04-76DP-00789)
(DE83-000391; SAND-81-7085/12) Avail NTIS HC A03/MF A01

Data accumulated during May at the intermediate photovoltaic project at Lovington Square Shopping Center, Lovington, New Mexico are presented. Generated energy and environmental data are presented graphically. Explanations of irregularities not attributable to weather are provided. DOE

**N83-16897# Boeing Computer Services, Inc., Seattle, Wash
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION
EXPERIMENT OPERATIONAL PERFORMANCE REPORT.
VOLUME 1: G. N. WILCOX MEMORIAL HOSPITAL, KAUAI,
HAWAII**

Sep 1982 70 p Prepared for Sandia Labs, Albuquerque, N. Mex
(Contract DE-AC04-76DP-00789)
(DE83-000393, SAND-81-7080/1-VOL-1) Avail NTIS HC A04/MF A01

Presented are the data accumulated during January, February, and March 1982 at the intermediate photovoltaic project at G.N. Wilcox Memorial Hospital, Kauai, Hawaii. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided. DOE

**N83-16898# Florida Solar Energy Center, Cape Canaveral
INNOVATIVE PHOTOVOLTAIC APPLICATION FOR
RESIDENCES EXPERIMENT Final Report**

G H ATMARAM and A H LITKA Jun 1982 108 p Prepared in cooperation with Lincoln Lab, MIT, Lexington
(Contract DE-AC02-76ET-20279)
(DE83-000399, DOE/ET-20279/210) Avail NTIS HC A06/MF A01

Operational results on the performance of the 5 kilowatt peak photovoltaic residential system at the Florida Solar Energy Center (FSEC) described. Operational performance results of 1 year on the FSEC photovoltaic residential system are presented. The description of the residence, photovoltaic system, instrumentation and data collection procedure is included. The performance of the photovoltaic array, inverters and total photovoltaic system is detailed. The instrumentation upgrading, system diagnostics, and any failures or system downtime are described. DOE

**N83-16900# Midwest Research Inst., Golden, Colo. Solar Energy
Research Inst.**

**ORGANIC RANKINE CYCLE COUPLED TO A SOLAR POND
BY DIRECT-CONTACT HEAT EXCHANGE - SELECTION OF A
WORKING FLUID**

J D WRIGHT Jun. 1982 36 p refs
(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE82-020998; SERI/TR-631-1122R) Avail NTIS HC A03/MF A01

Heat from a solar pond may be used to drive an organic Rankine cycle and produce electricity. Due to the inherent low efficiency of low temperature cycles, large amounts of heat must be transferred, and heat exchangers may account for up to 50% of the plant cost. Use of a direct contact boiler, in which the organic fluid is bubbled through a stream of pond brine, may reduce the plant cost by about 25%. The choice of a working fluid affects plant efficiency, turbine cost, and the loss rate of the organic fluid. Low vapor pressure fluids maximize cycle efficiency by minimizing pumping requirements, but require a larger turbine. Efficiency affects the size and cost of the entire plant and low pressure fluids are preferred. The saturated and halogenated hydrocarbons were evaluated for use as working fluids. It is found that the working fluid is best suited to this application, because of

02 SOLAR ENERGY

high efficiency, low solubility in the pond, and a reasonable turbine cost
DOE

N83-16908# Arizona State Univ, Tempe Dept of Mechanical Engineering
PERFORMANCE OF AN EXPERIMENTAL PHOTOVOLTAIC-POWERED HOUSE
B W. MCNEILL and F J SOLMAN (MIT) 1981 5 p Presented at the Ann Conf of the Intern Solar Energy Soc., Philadelphia, 27-30 May 1981
(Contract DE-AC02-76ET-20279)
(DE82-000662; DOE/ET-20279-158, CONF-810509-41) Avail
NTIS HC A02/MF A01

A utility interactive photovoltaic power system in operation since May of 1980 at a model home is discussed. System, inverter, and cell performance are presented along with some discussion of the economic impact of such a system on the owner's utility bill. By March 1, 1981, the system produced 5463 KWh of energy. The overall system efficiency of just over 5% has held constant. Design modifications made on the inverter improved the inverter efficiency by 10 percentage points and raised the power factor by .15 points. Array reliability improved in the winter with only five array shorts to ground being reported.
DOE

N83-16909# Houston Univ, Tex Dept of Physics
LONG TERM SOLAR IRRADIATION HEATING OF BLACK CHROME Final Report
A IGNATIEV 28 Dec. 1981 9 p
(Contract DE-AC03-81SF-11492)
(DE83-000032, DOE/SF-11492-T6) Avail NTIS HC A02/MF A01

The effect of high solar fluxes (0.1 to 2.0 MW/m²) in conjunction with high temperatures (350 to 5000C) on the optical response, chemical composition and microscopic structure of black chrome films was studied by exposing the films to concentrated solar radiation for extended periods of time (10 hours) in air. The optical response of the samples was defined through measurement of their spectral hemispherical reflectance. The samples were mounted on specially constructed holders which had the capability of cooling the sample and the resulting control of the sample temperature under irradiation. Five separate samples were solar irradiated in a solar furnace
DOE

N83-16911# Boeing Co, Seattle, Wash
SOLAR PROJECT DESCRIPTION FOR ENVIRONMENTAL PARTNERSHIP, UPPER FREEHOLD TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY
16 Aug. 1982 47 p
(Contract DE-AI01-76CS-31020)
(DE83-001068; SOLAR/1027-82/50) Avail NTIS HC A03/MF A01

A solar house is described. It is a three-story single family detached residence in New Jersey. It is equipped with a 540 cubic foot vented Trombe wall constructed of concrete filled concrete blocks and glazed with 344 square feet of insulated tempered glass. Heat is also provided by a 168 square foot sunspace of insulated glass. In the loft area is a phase change storage system composed of 32 PSI Thermal-81 phase change storage rods. Auxiliary heating is by a wood-burning stove and a dual-fuel, propane and wood, forced air furnace. A breadbox type hot water preheater is located on the roof. Summer cooling is accomplished by opening windows, doors, and exhaust dampers and operating a whole house ventilation fan. Operation of the solar system and the auxiliary subsystems may involve one or more of 5 modes: collector-to-storage, storage-to-space heating, auxiliary-to-space heating, energy-to-load-summer cooling, and domestic hot water. The house, its solar heating systems, storage, load, operation, on-site performance evaluation instrumentation, and data depicting the solar portion of construction costs are outlined.
DOE

N83-16914# Georgia Inst. of Tech, Atlanta. Engineering Experiment Station.

DESIGN OF A VORTEX-FLOW SOLAR CHEMICAL REACTOR Final Technical Report
H L. TEAGUE and S H. BOMAR, JR Dec. 1981 31 p refs
Prepared for Houston Univ
(Contract DE-AC03-81SF-11492)
(DE83-000031, DOE/SF-11492-T5) Avail: NTIS HC A03/MF A01

A preliminary investigation of a vortex-flow chemical reactor, fired by concentrated solar radiation is discussed. The reactor would be capable of containing gaseous and solid particle reactants in the presence of high-flux radiant thermal energy, leading to chemical reactions which store solar process energy in chemical bonds. The vortex-flow reactor concept appears to offer important technical advantages in process control, compared with other methods such as fluidized beds. Specifically, the flow rates of the entraining gases and the reactant gases can be varied independently in response to changes in power level caused by variations in solar intensity. A model vortex-flow reactor was constructed and operated to determine its control characteristics at room temperature. A preliminary design was developed for a reactor suitable for testing.
DOE

N83-16916# Ohio State Univ, Columbus Dept of Physics
SALT GRADIENT SOLAR POND DEVELOPMENT Final Report
C E NIELSEN 1981 40 p refs
(Contract DE-FG04-77CS-34155)
(DE82-020630, DOE/CS-34155-T1) Avail: NTIS HC A03/MF A01

A research solar pond was constructed. From the operation of this pond and the continuing operation of the Farm Science review pond completed in 1975 important new information on pond performance and operating procedures has been obtained. Work discussed here includes design and construction of the research pond, measurement of energy balance and efficiency, measurements of salinity profiles and their use in determining salt transport rate, study of surface zone growth and the processes responsible for it, study of the processes involved in the interface between convective and gradient zones, tests of heat extraction systems, and measurement and control of water quality.
DOE

N83-16917# Perkin-Elmer Corp, Norwalk, Conn
POLYCRYSTALLINE SOLAR CELL/SUBSTRATE GROWTH BY INTEGRATED VACUUM EVAPORATION Final Report
D. L. SMITH Feb 1982 35 p refs
(Contract DE-AC02-77CH-00178)
(DE82-017203; SERI/TR-8041-14-T1) Avail: NTIS HC A03/MF A01

GaAs epitaxy on a large-grained substrate would reduce grain-boundary shunting losses in polycrystalline solar cells. In pre-contract work, Fe was selected for its low cost and 1.4% lattice match, and was e-beam evaporated onto 850 to 11000C alumina and Kovar wafers, selected for reasonably good thermal expansion match to GaAs. Fe films developed 30 to 200 micrometers grains with a (211) texture and did not crack or peel upon cooldown. Under the contract, clean, single-crystal Fe surfaces for GaAs growth studies were generated by epitaxial growth of Fe onto 3000C GaAs(211), but the reverse process, GaAs growth on Fe (by vacuum deposition from Ga and As₄) produced polycrystalline Ga-As-Fe mixed phases. The success of Fe epitaxy on GaAs is attributed to the availability of Ga and As at the interface only as the compound GaAs, which raises the activation energy for the formation of mixed phases. Fe passivation by NH₃ and H₂S exposure was tried unsuccessfully, although H₂S did passivate Fe against As₄. Various closely lattice-matching materials were vacuum-deposited on the Fe as buffer layers prior to GaAs growth. AlAs and Ge formed mixed phases with the Fe.
DOE

N83-16920# Boeing Engineering and Construction Co., Seattle, Wash

THE 1-MW(TH) SOLAR-THERMAL CONVERSION FULL-SYSTEM EXPERIMENT

D H BARTLETT Aug 1982 71 p

(Contract EPRI PROJ. 1509-1)

(DE82-906454, EPRI-AP-2435-SY) Avail NTIS HC A04/MF A01

Progress made during the first phase effort of the Solar Thermal Full-System Experiment is summarized. This is one of a number of projects in the Solar-Thermal Subprogram involved with the development of solar central receiver hardware and systems for future use by utilities. The main emphasis is on systems that use Brayton-Cycle (gas turbine) equipment. The project summarized involves the planning and design of a complete Brayton-Cycle solar central receiver experimental system that would include all components of a commercial-size electric utility solar power plant. The objective of the overall project is to demonstrate the technical feasibility of a complete Brayton-Cycle, solar-fossil hybrid central receiver system. Major objectives of the Phase I effort summarized are to plan and design the experiment in detail and to organize a utility Test and Operating Group that would be directly involved in the development and operation of the experiment. DOE

N83-16927# Los Alamos Scientific Lab., N. Mex
PENETRATION FOR FOUR SOLAR TECHNOLOGIES IN ELECTRIC UTILITIES AND THE ENVIRONMENTAL BENEFITS
R J. SUTHERLAND Dec 1981 42 p refs

(Contract W-7405-ENG-36)

(DE82-010864, LA-9149-TASE) Avail NTIS HC A03/MF A01

A structural model of a public utility to estimate the penetration by four solar technologies: wind, biomass, photovoltaics, and solar thermal, for electric installed capacity and power generated is examined. The displacement of coal plants implies a displacement of their air emissions, such as sulfur dioxide, oxides of nitrogen, and particulate matter. It is concluded that solar thermal, photovoltaics, and biomass fail to penetrate significantly by the end of this century in any Federal region. Wind energy penetrates the electric utility industry in several regions during the 1990s. Displaced coal and nuclear generation are also estimated by region, as are the corresponding reductions in air emissions. A moderate displacement of sulfur dioxide and the oxides of nitrogen is estimated to occur by the end of this century, and significant lowering of these emissions should occur in the early part of the next century. GRA

N83-16936# Commission of the European Communities, Luxembourg

INDUSTRIAL TECHNOLOGY FOR ECONOMIC AND VIABLE ENCAPSULATION FOR LARGE SOLAR PANELS Final Report

J. ANGUET (RTC, Caen, France) and Y. SALLES (RTC, Caen, France) 1981 21 p. Transl into ENGLISH of the mono "Technologie Industrielle d'Encapsulation Economique et Fiable pour Panneaux Solaires de Grandes Dimensions" France, 1981

(PB82-259839, EUR-7163-FR) Avail NTIS HC A02/MF A01 CSCL 10B

The laminated glass technology used in buildings and car windscreens is applied to the encapsulation of solar panels so as to form a glass-polyvinylbutyral-glass 'sandwich'. Based on small scale experimental panels, the following studies were made: (1) adhesion techniques; (2) structure studies to find the most suitable means for maintaining the mechanical stability of the cells; (3) types of connections for the solar panels, and (4) climatic tests and humidity resistance. Mechanical and climatic tests with the minimodules gave encouraging results, whereupon larger scale models were designed. The results obtained with these confirmed those obtained with the minimodules. GRA

N83-16939# Swedish Council for Building Research, Stockholm
SOLAR DISTRICT HEATING WITH EVACUATED COLLECTORS: FIRST YEAR EXPERIENCE OF THE KNIVSTA PLANT

E. KJELLSON, B. PERERS, H. ZINKO, and L. ASTRAND 1981 49 p

(PB82-262114; D10-1982, ISBN-91-540-3721-2) Avail NTIS HC A03/MF A01 CSCL 13A

The experience gained during the summer enable some practical demands to be placed on solar collectors, namely it must be possible to easily replace a solar collector without emptying the system, it must be easy to bleed the system, solar collectors must be able to withstand overheating due to boiling, and obvious leakage risks must be eliminated. There is no doubt that not all types of evacuated solar collectors fulfill these requirements and that further development is essential before large-scale installations with rational operation can be considered. GRA

N83-16940# Mueller Associates, Inc., Baltimore, Md
THERMAL PERFORMANCE CASE STUDIES FOR RESIDENTIAL SOLAR HEATING AND COOLING SYSTEMS Final Report

A. H. CREMEANS and R. E. HEDDEN Jun 1981 167 p refs

Sponsored in part by HUD

(Contract NBS-79-3534)

(PB82-260100, NBS/GCR-82-397, MAI-213) Avail NTIS HC

A08/MF A01 CSCL 13A

Five case studies on thermal performance of selected solar system designs which served as a vehicle for examining the applicability of the draft performance criteria for solar heating and cooling systems in residential buildings are given. The purpose was to identify shortcomings in the draft version of the performance criteria by means of attempting to implement the criteria. Those aspects of the criteria that require revision were highlighted. Author (GRA)

N83-16946# Fachhochschule, Esslingen (West Germany) Lab fuer Lueftungs- und Klimatechnik

SOLAR ENERGY PLANT AS A COMPLEMENT TO A CONVENTIONAL HEATING SYSTEM: MEASUREMENT OF THE STORAGE AND CONSUMPTION OF SOLAR ENERGY Final Report, 1 Oct. 1977 - 30 Sep. 1978

E. DOERING and W. LIPPE Aug 1982 49 p refs Transl into ENGLISH from the mono "Solarenergieanlage zur

Engaenzung einer Konventionellen Heizung- Messung der Einspeicherung und des Verbrauchs von Solarer Waermeenergie"

West Germany, Sep 1980 Sponsored in part by Bundesministerium fuer Forschung und Technologie, Bonn

(PB82-255209, BMFT-FB-T-80-079, BMFT-03E5060A/ETS8001A)

Avail NTIS HC A03/MF A01 CSCL 13A

The technical and economic performances of a complementary solar heating installation for a new swimming pool added to a two-floor dwelling were examined after measurements were taken over a period of 12 months and analyzed. In particular, the heat absorption and utilization were measured and modifications were carried out to improve pipe insulation and regulation of mixer valve motor running and volume flow. The collector system efficiency was evaluated at 15.4%, the proportion of solar energy of the total consumption being 6.1%. The solar plant and the measuring instruments are described and recommendations are made for improved design and performance, including enlargement of the collector surface area, further modification of the regulation system, utilization of temperature stratification in the storage tanks and avoiding mutual overshadowing of the collectors. GRA

02 SOLAR ENERGY

N83-16948# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

A HIGHLY EFFICIENT COLLECTOR FOR SMALL SOLAR ENERGY INSTALLATIONS

E. OBERMAYR, W. MOLT, D. SCHNELLER, and K. SPEIDEL. Aug. 1982. 72 p. Transl. into ENGLISH of the mono "Hochleistungskollektor fuer Sonnenenergie-Kleinanlagen" Bonn, Sep 1981 p 1-100. Original language document available as N82-15538. Sponsored in part by Bundesministerium fuer Forschung und Technologie (PB82-255191; BMFT-FB-T-81-156). Avail. NTIS HC A04/MF A01 CSCL 10A.

Highly efficient collectors to be used for small solar powered facilities (solar cooling processes and solar powered facilities for mechanical or electric energy production) were developed. A series of preliminary investigations and laboratory tests were performed, which form the basis of collector designs. Due to the results of the performed tests it was decided to develop vacuum flat plate collectors instead of concentration on collectors as an alternative version in this special form of applications. The function of this collector is different, as the working medium is evaporated within the collector itself, the collector is an evaporator. Different designs have been planned and investigated. Prototypes of direct evaporation collectors have been constructed and tested. GRA

N83-17001# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

TERRESTRIAL SOLAR SPECTRAL DATA SETS

R. E. BIRD and R. L. HULSTROM. Jun 1982. 35 p. refs. (Contract DE-AC02-77CH-00178) (DE83-000504, SERI/TR-642-1149). Avail. NTIS HC A03/MF A01.

The needed solar spectra irradiance data sets representative of solar spectra under average conditions in the United States, are presented. Two new spectral irradiance data sets update two standards. One data set is for the direct normal irradiance within a 5.80 field of view, and the other set is for the global irradiance falling on a flat surface. The data are generated from a new extraterrestrial spectrum and a Rayleigh scattering calculation. The performance of solar products are compared, and absorptance, reflectance, transmittance, and responses of various devices and materials are evaluated. DOE

N83-17723# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

STABILITY OF REFLECTORS WITH POLYMERIC COATINGS

P. SCHISSEL and A. W. CZANDERNA. Jan 1982. 20 p. refs. Presented at the Electrochem Soc Corrosion in Solar Energy Systems Conf., Denver, 12-13 Oct 1981. (Contract DE-AC02-77CH-00178, EG-77-C-01-4042) (DE82-007774; SERI/TP-255-1497, CONF-811013-20). Avail. NTIS HC A02/MF A01.

One of the possible solutions for improving mirrors for longlife, inexpensive solar concentrators is to coat the reactive mirror material with a polymer. Polymer-coated reflectors may improve optical efficiency and reduce the cost of solar mirrors. Because the mirror/polymer interface may have long-term instabilities in a solar-stressed environment, it is necessary to isolate the effects attributable to the bulk materials from those of the interface. The literature on one of the systems of great current interest, the silver/polymer interface, is reviewed. First, the components of this interface are considered separately. Studies of reactions of environmental gases with silver are summarized. Then, candidate fluoropolymers and polymethylmethacrylate are considered independently of the metal. The thermal, photo, and oxidative degradation reactions are outlined briefly. DOE

N83-17871*# Old Dominion Univ., Norfolk, Va. Dept. of Physics.

THEORETICAL STUDIES OF SOLAR-PUMPED LASERS

Progress Report, 16 Jul. 1982 - 15 Jan. 1983. W. L. HARRIES. Jan. 1983. 37 p. refs. (Contract NSG-1568) (NASA-CR-169890; NAS 1.26 169890). Avail. NTIS HC A03/MF A01 CSCL 20E.

Possible types of lasers were surveyed for solar power conversion. The types considered were (1) liquid dye lasers, (2) vapor dye lasers, and (3) nondissociative molecular lasers. These are discussed. S.L.

N83-18023*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMPARATIVE VALUES OF ADVANCED SPACE SOLAR CELLS

L. W. SLIFER, JR. Sep 1982. 21 p. refs. Presented at the 16th IEEE Photovoltaic Spec. Conf., San Diego, Calif., 27-30 Sep 1982. (NASA-TM-84951, REPT-711, NAS 1 15 84951). Avail. NTIS HC A02/MF A01 CSCL 10A.

A methodology for deriving a first order dollar value estimate for advanced solar cells which consists of defining scenarios for solar array production and launch to orbit and the associated costs for typical spacecraft, determining that portion affected by cell design and performance and determining the attributable cost differences is presented. Break even values are calculated for a variety of cells, confirming that efficiency and related effects of radiation resistance and temperature coefficient are major factors, array tare mass, packaging and packing factor are important, but cell mass is of lesser significance. Associated dollar values provide a means of comparison. Author

N83-18025*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CHALCOGENOPHOSPHATE PHOTOELECTRODES Patent Application

B. REICHMAN (Christopher Newport Coll.) and C. E. BYVIK, inventors (to NASA). 7 Oct 1982. 14 p. (NASA-CASE-LAR-12958-1; US-PATENT-APPL-SN-433196). Avail. NTIS HC A02/MF A01 CSCL 10A.

A device for converting light energy into other forms of useful energy such as electrical or chemical energy is described. A photoelectrode is manufactured from a layered chalcogenophosphate (MPX3) compound employed in a photoelectrochemical cell where M is selected from the group consisting of the transition metal series of elements beginning with scandium (atomic number 21) through germanium (atomic number 32), yttrium (atomic number 39) through antimony (atomic number 51), and lanthanum (atomic number 57) through polonium (atomic number 84); P is phosphorus, and X is selected from the chalcogenide series consisting of sulfur, selenium, and tellurium. The photoelectrochemical cell is comprised of a container which retains an acidic electrolyte solution, an MPX3 photoelectrode, and a counterelectrode. In the preferred embodiment, the photoelectrochemical cell is set up as a photoelectrolysis cell. NASA

N83-18043# Sandia Labs., Albuquerque, N. Mex.

THE 5 MW FOR SOLAR-CHEMISTRY DEVELOPMENT

J. T. HOLMES. 1981. 16 p. refs. Presented at the AIChE Natl. Meeting, Orlando, Fla., 28 Feb. - 4 Mar 1982. (Contract DE-AC04-76DP-00789) (DE82-002064, SAND-81-1284C, CONF-820202-2). Avail. NTIS HC A02/MF A01.

The US-DOE, 5MW solar Central Receiver Test Facility (CRTF) operates to develop and proof-test high efficiency solar receivers and collectors (heliostats) for applications such as electricity generation and process heating. The capabilities of CRTF for solar chemical process development studies are described and related to chemical reactant heating rates. A Sun Fuels program is planned to demonstrate a process for upgrading both nonrenewable and

renewable feedstocks into conventional fuels. To additionally benefit from the high intensity light source, studies on the direct solar pyrolysis of metal halides and carbonyls to produce high purity, high value metals are recommended DOE

N83-18044# Massachusetts Inst of Tech., Cambridge
DATA REPORT FOR THE NORTHEAST RESIDENTIAL EXPERIMENT STATION, OCTOBER 1981
 M C. RUSSELL, P RAGHURAMAN, and P. C MAHONEY Nov 1981 14 p
 (Contract DE-AC02-76ET-20279)
 (DE82-007648, DOE/ET-20279/174) Avail NTIS HC A02/MF A01

The Residential Experiment Stations of the Solar Photovoltaic Residential Project were designed to develop residential photovoltaic systems and to gather and disseminate performance data for the photovoltaic community, cognizant institutions and, ultimately, the public. Physical performance data for the month of October 1981 obtained from photovoltaic energy systems under test at the Northeast Residential Experiment Station in Concord, Massachusetts are tabulated DOE

N83-18046# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
COMPARISON OF HEAT PUMP WATER HEATERS AND SOLAR DOMESTIC WATER HEATERS
 L MORRISON and D. E CLARIDGE Dec 1981 6 p refs
 Presented at the Semiann Meeting of the Am Soc of Heating, Refrigerating, and Air Conditioning Engr, Houston, Tex, 24-28 Jan 1982
 (Contract DE-AC02-77CH-00178, EG-77-C-01-4042)
 (DE82-006117, SERI/TP-254-1482, CONF-820112-1) Avail NTIS HC A02/MF A01

The heat pump water heater (HPWH) is described and life-cycle cost analyses are presented for the HPWH and the solar domestic water heater. DOE

N83-18049# Brookhaven National Lab, Upton, N Y Dept of Energy and Environment
AN ANALYSIS OF SELECTED SURFACE CHARACTERISTICS AND LATENT HEAT STORAGE FOR PASSIVE SOLAR SPACE HEATING
 V FTHENAKIS and R LEIGH Dec 1981 16 p refs
 Presented at the 4th Intern. Conf. on Alternative Energy Sources, Miami, Fla., 14-16 Dec. 1981
 (Contract DE-AC02-76CH-00016)
 (DE82-006932, BNL-30441; CONF-811212-12) Avail NTIS HC A02/MF A01

Results are presented of an analysis of the value of various technical improvements in the solar collector and thermal storage subsystems of passive solar residential, agricultural, and industrial systems for two regions of the country. The evaluated improvements are decreased emissivity and increased absorptivity of absorbing surfaces, decreased reflectivity, and decreased emissivity of glazing surface, and the substitution of sensible heat storage media with phase change materials. The value of each improvement is estimated by the additional energy savings resulting from the improvement DOE

N83-18050# Los Alamos Scientific Lab, N Mex
SOLAR-ABSORBER-SELECTIVE PAINT RESEARCH
 S W MOORE 1982 9 p refs
 Presented at the Soc of Photo-Optical Instr Engrs, Los Angeles, 25-29 Jan 1982
 (Contract W-7405-ENG-36)
 (DE82-006104, LA-UR-81-3610; CONF-820107-3) Avail NTIS HC A02/MF A01

Research and development on thickness-sensitive and thickness-insensitive solar paints are discussed. The thickness-sensitive paints include reverse roll coated, gravure printed, and spray coated paints. The coating methods and optical properties of the thickness-sensitive paints are discussed. The thickness-insensitive solar paints include a low emittance flake such as aluminum-flake, and pigment. Durability tests are discussed,

including accelerated weathering and humidity durability tests, for the thickness-sensitive coatings DOE

N83-18053# Pacific Northwest Lab, Richland, Wash
HYBRID SOLAR-WIND ENERGY CONVERSION SYSTEMS METEOROLOGICAL ASPECTS
 C I ASPLIDEN Dec 1981 16 p refs
 Presented at the WMP Tech Conf on Meteorol and Energy, Mexico City, 3-7 Nov. 1981
 (Contract DE-AC06-76RL-01830)
 (DE82-005798, PNL-SA-10063; CONF-811175-1) Avail NTIS HC A02/MF A01

Both the solar and wind resources available in the boundary layer vary in time and space. Data indicate, however, that the availability of the two resources may complement each other on both short and long term bases in many regions to meet different load requirements in various applications. This suggests that solar-wind hybrid systems may be more attractive and suitable to meet specific power demands and/or to avoid expensive storage systems (or expansion of conventional systems) than wind or solar energy extracting systems alone. To investigate the feasibility of operation of hybrid wind-solar systems at a particular site requires detailed and simultaneously acquired information on solar and wind energy availability on time scales from minutes to hours over a period of at least a year. Such data sets are rare and even then they are seldom found to be representative DOE

N83-18056# Oak Ridge National Lab, Tenn.
APPLICATION OF LASER ANNEALING AND LASER-INDUCED DIFFUSION TO PHOTOVOLTAIC CONVERSION
 R. T. YOUNG, G A VANDERLEEDEN, and R F WOOD 10 Dec. 1981 21 p refs
 Presented at the SERI Polycryst Silicon Solar Cells Topical Rev on High Efficiency, Washington, D C, 10 Dec. 1981
 (Contract W-7405-ENG-26)
 (DE82-006792, CONF-811224-1) Avail. NTIS HC A02/MF A01

High efficiency silicon solar cells can be fabricated by ion implantation followed by pulsed laser annealing. The proper choice of implantation parameters (energy and dose), laser energy density, substrate temperature, and the improvement of the minority carrier diffusion length of the starting material are important factors in obtaining high efficiency cells. Recently, it was shown that substrate heating during pulsed laser annealing can improve the electrical properties of the emitter regions of solar cells. It was found that the open circuit voltage and the fill factor of ion implanted, laser-annealed cells can be improved by increasing the emitter dopant concentration, whereas the short circuit current remains fairly constant, these results are in only qualitative agreement with theoretical predictions. Single crystal Si solar cells with efficiencies of over 16% were obtained DOE

N83-18059# Midwest Research Inst, Golden, Colo Solar Energy Research Inst
EFFECTS OF GRAIN BOUNDARIES IN GAAS SOLAR CELLS
 J P BENNER and A E BLAKESLEE Dec 1981 13 p refs
 Presented at the Mater Res Soc Meeting, Boston, 16-19 Nov 1981
 (Contract DE-AC02-77CH-00178, EG-77-C-01-4042)
 (DE82-006118, SERI/TP-212-1493, CONF-811122-48) Avail NTIS HC A02/MF A01

Many problems exist in current attempts to develop polycrystalline GaAs as a basis for thin-film solar cells. Some of these problems arise from the direct interaction of carriers, both dark and photo-generated, with grain boundaries. Others are more indirect, e.g., shunting currents due to the grain boundary-enhanced diffusion of contaminating impurities. Several of these effects are described, including the influence of system chemistry on grain properties, the correlation of device parameters with grain size, and grain boundary passivation experiments. A review of various approaches to solving the problems confronting the field is given, and an attempt is made to interpret observations in terms of existing theoretical models DOE

02 SOLAR ENERGY

N83-18062# Sandia Labs., Albuquerque, N Mex. Central Receiver Test Facility

SOLAR FURNACE FOR FLUX GAGE CALIBRATION AND THERMAL-EFFECTS TESTING

R. M. EDGAR, E. H. RICHARDS, and G. P. MULHOLLAND (New Mexico State Univ., Las Cruces) 1981 18 p Presented at the Solar Thermal Test Facility Users Assoc Meeting, Albuquerque, N. Mex., 26 Oct. 1981

(Contract DE-AC04-76DP-00789)

(DE82-005769, SAND-81-1776C; CONF-8110154-1) Avail. NTIS HC A02/MF A01

A solar furnace to calculate gauge flux and thermal effects was studied. The solar furnace consists of a 7.4 m square heliostat, a 6.7 m diameter concentrator, an attenuator designed to vary the flux density at the test area, and a three axis positioning table at the test area. Its primary function is the calibration of flux gages but other tasks and/or experiments will be considered as time permits. DOE

N83-18063# Institute of Gas Technology, Chicago, Ill
HIGH-TEMPERATURE COMPOSITE LATENT/SENSIBLE HEAT STORAGE

T. D. CLAAR and R. J. PETRI 1981 7 p refs Presented at the Ann. Contractors' Rev Meeting on Thermal and Chem Storage, Tysons Corner, Va., 16 Sep 1981

(Contract DE-AC02-77CH-00178)

(DE82-010396, CONF-810940-29) Avail. NTIS HC A02/MF A01

A composite latent/sensible media concept was evaluated for technical and economic feasibility of satisfying high-temperature solar thermal energy storage requirements. The approaches taken to identify and resolve critical technical issues associated with this advanced TES concept are discussed. DOE

N83-18069# Oak Ridge National Lab., Tenn Efficiency and Renewables Research Section

STARTUP EXPERIENCE WITH A CONCENTRATING PHOTOVOLTAIC POWER SYSTEM

S. I. KAPLAN 1982 16 p refs Presented at the 20th Aerospace Sci. Conf., Orlando, Fla., 11-14 Jan 1982

(Contract W-7405-ENG-26)

(DE82-008833; CONF-820106-6) Avail. NTIS HC A02/MF A01

The startup testing of a solar photovoltaic power system located at Mississippi County Community College, Blytheville, Arkansas is examined. A review of problems encountered and methods of investigation are included, as well as assessments of the underlying causes and remedial action accomplished. The observed power output capacity and plausible levels of future improvement are also discussed. DOE

N83-18072# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif

SOLAR-COLLECTOR MATERIALS EXPOSURE TO THE IPH SITE ENVIRONMENT. TASK 5.0 Final Report

V. L. MORRIS Jul. 1982 68 p refs

(Contract DE-AC04-76DP-00789)

(DE83-002192; SAND-81-7029) Avail. NTIS HC A04/MF A01

An environmental exposure test was conducted at a site which utilizes solar energy for enhanced oil recovery procedures. Two types of reflector materials were evaluated for survivability in this environment. Second surface silvered glass and aluminized acrylic (FEK-244) on an aluminum substrate. Black chrome absorber material and low iron float glass were evaluated for thermal, photochemical and environmental degradation. The reflector specimens were monitored for decreases in specular and hemispherical reflectance due to soil buildup. The absorber material is evaluated for changes in solar absorptivity and emissivity and the glass cover plates is evaluated for changes in transmissivity. DOE

N83-18491# Pacific Northwest Lab., Richland, Wash. Materials Dept

OPTICAL PROPERTIES OF SPUTTERED Si:H

P. M. MARTIN, W. T. PAWLEWICZ, and I. B. MANN Dec 1981 18 p refs Presented at the SPIE Optical Coatings for Energy Efficiency and Solar Appl. Conf., Los Angeles, 25 Jan 1982

(Contract DE-AC06-76RL-01830)

(DE82-007072; PNL-SA-9858A, CONF-820107-5) Avail. NTIS HC A02/MF A01

Sputtered Si:H is a very promising material for use in thin film solar cells, solar selective absorbers and optical coatings for the near infrared. Optical property - composition relationships have been determined for Si:H coatings having wide ranges of H content and Si:H bonding. The dependence of the optical absorption edge, optical band gap and refractive index at 2 micrometers wavelength on H content and Si:H bonding is described. Microstructural and topographical features of the films which influence their absorption and scattering characteristics are discussed. Composition and bonding diagrams used to select deposition conditions for the desired optical properties are also presented. Finally, multilayer Si:H/SiO₂ all-dielectric laser mirrors with reflectances greater than 99% at 1.315, 2.7 and 3.8 micrometers are described to illustrate the application of these coatings. DOE

N83-18921# National Bureau of Standards, Washington, D C Active Heating and Cooling Div.

SOLAR ENERGY SYSTEMS: STANDARDS FOR SCREENING PLASTIC CONTAINMENT MATERIALS

E. J. CLARK, C. D. KELLY, and W. E. ROBERTS Jun. 1982 55 p refs Sponsored in part by DOE

(PB82-242454, NBSIR-82-2533) Avail. NTIS HC A04/MF A01 CSDL 111

Plastic materials are being chosen more frequently for various applications in solar energy systems. Problems with materials in solar systems indicated a need for standards to assess the performance and durability of the materials. In this investigation laboratory studies were performed to obtain data needed to develop standards to screen plastic containment materials for the effects of heat and for compatibility with heat transfer fluids. Five absorbers, three plastic pipe materials, and three plastics used in storage applications were included. They were evaluated to assess their durability after exposure to heat aging at 100 C and 125 C and to chemical compatibility with six heat transfer fluids at room temperature and at 70 C. The results of the laboratory tests were presented and a draft standard to screen plastic containment materials is proposed. GRA

N83-18967# Booz-Allen and Hamilton, Inc., Bethesda, Md
COMPETITIVE ASSESSMENT OF DESICCANT SOLAR/GAS SYSTEMS FOR SINGLE FAMILY RESIDENCES Final Report, Aug. 1981 - Jan. 1982

Jan 1982 111 p Sponsored by Gas Research Inst

(PB82-243825, GRI-81/0063) Avail. NTIS HC A06/MF A01 CSDL 13A

The solar/gas desiccant space conditioning system was compared with competing gas and electric technologies. Benefits and costs to the residential gas customer were evaluated, and practical recommendations regarding an appropriate R&D agenda to maximize the probability of successful development of an advanced desiccant system for that market were provided. GRA

N83-18968# Exxon Corp., Florham Park, N.J. Energy Venture Development Group

ADVANCED SOLAR/GAS DESICCANT COOLING SYSTEM Final Report

B. HUSKEY, J. SHARP, A. VENERO, and M. YEN Feb 1982 89 p refs

(PB82-243833, GRI-81/0064) Avail. NTIS HC A05/MF A01 CSDL 13A

A desiccant cooling system with significantly higher thermal efficiency than current state of the art desiccant systems is studied. The findings and data are based on extensive computer modeling and actual operating test results of an experimental breadboard.

unit employing an approach developed for the separation of moisture from an airstream using solid desiccants (silica gel). The results confirmed the theoretical concept of efficiency improvement over desiccant concepts and validated the computer model used for sizing and simulating the desiccant process. The results also identified specific components and areas of the system needing improvements such as air seals, wheel drive mechanisms, air distribution and materials. GRA

N83-19136# Sandia Labs, Albuquerque, N. Mex.
CONTACT STRESSES ON A THIN PLATE AFTER LARGE DISPLACEMENTS TO A HALF PARABOLIC SURFACE
 R. K. WILSON and R. C. REUTER, JR. Jan. 1982 30 p refs
 (Contract DE-AC04-76DP-00789)
 (DE82-006998, SAND-81-2563) Avail: NTIS HC A03/MF A01

All loads necessary to hold an initially flat, thin, elastic plate in the shape of a prescribed parabolic surface, following large displacement were determined. These loads include spatially varying normal tractions distributed over the back surface of the plate, and a uniform shear force and bending moment applied along the opposing edges which become the rims of the parabola after deformation. In actual practice the edge loads are not present, and, as a result, local displacement and stress variations arise creating what is known as an edge effect. Furthermore, if the full parabola is separated into two equal halves at the vertex another edge effect occurs. The analysis used to compute the local displacement and stress variations arising near the rim is repeated here to treat the absence of edge loads at the vertex. In addition to the normal stresses which arise, shear stresses result from the absence of the membrane reaction at the vertex, which was present in the case of the full parabolic surface. Correlation between the theory and data from laser ray trace experiments is also presented. DOE

N83-19215# Applied Concepts Corp., Woodstock, Va.
THERMAL SYSTEM ENGINEERING EXPERIMENT Final Report
 29 Oct 1982 69 p Prepared for JPL
 (Contract NAS7-100; JPL-955926)
 (NASA-CR-169901, NAS 1 26 169901; K05-01-82-FR) Avail: NTIS HC A04/MF A01 CSCL 10B

The technical feasibility of a solar thermal collector to provide process steam in an industrial environment was determined. The form of the experiment was an industrial field test. Author

N83-19219# Mobil Tyco Solar Energy Corp., Waltham, Mass.
LARGE AREA SILICON SHEET BY EFG Final Report, 29 Oct. 1975 - 31 Dec. 1981

J. P. KALEJS 15 Sep 1982 88 p refs Sponsored in part by DOE Prepared for JPL, Washington, D C
 (Contract JPL-954355)
 (NASA-CR-169920, JPL-9950-774, DOE/JPL-954355/81-21, NAS 1 26 169920) Avail: NTIS HC A05/MF A01 CSCL 10A

Work carried out on the JPL Flat Plate Solar Array Project, for the purpose of developing a method for silicon ribbon production by Edge-defined Film-fed Growth (EEG) for use as low-cost substrate material in terrestrial solar cell manufacture, is described. A multiple ribbon furnace unit that is designed to operate on a continuous basis for periods of at least one week, with melt replenishment and automatic ribbon width control, and to produce silicon sheet at a rate of one square meter per hour, was constructed. Program milestones set for single ribbon furnace operation to demonstrate basic EEG system capabilities with respect to growth speed, thickness and cell performance were achieved for 10 cm wide ribbon steady-state growth at 4 cm/min and 200 micron thickness over periods of an hour and longer was made routine, and a small area cell efficiency of 13+ % demonstrated. Large area cells of average efficiency of 10 to 11%, with peak values of 11 to 12% were also achieved. The integration of these individual performance levels into multiple ribbon furnace operation was not accomplished. Author

N83-19220# Spectrolab, Inc., Sylmar, Calif.
DEVELOPMENT OF METALLIZATION PROCESS, FSA PROJECT, CELL AND MODULE FORMATION RESEARCH AREA Quarterly Technical Report, period ending 30 Sep. 1982
 A. GARCIA, III Nov 1982 13 p Sponsored in part by DOE Prepared for JPL
 (Contract JPL-956205)
 (NASA-CR-169902; DOE/JPL-956205-82/2, NAS 1 26 169902, DRL-175; QTR-6329-6) Avail: NTIS HC A02/MF A01 CSCL 10A

Solar cells without AR coating achieved efficiencies of 10.5% with the Type A Mo/Sn/TiH paste. Curve shape, series resistance, and shunt resistance are all excellent and comparable to silver paste controls. Other pastes were not successful. Author

N83-19221# Westinghouse Electric Corp., Pittsburgh, Pa.
 Advanced Energy Systems Div.
PROCESS RESEARCH OF NON-CZ SILICON MATERIAL. LOW COST SOLAR ARRAY PROJECT, CELL AND MODULE FORMATION RESEARCH AREA Quarterly Report, 1 Sep. - 30 Nov. 1982

1982 38 p Prepared for JPL
 (Contract JPL-955909)
 (NASA-CR-169899; DOE/JPL-955909-82/8, NAS 1 26 169899; DRL-157, DRD-SE-2, TME-3170, QR-3) Avail: NTIS HC A03/MF A01 CSCL 10A

Liquid diffusion masks and liquid applied dopants to replace the CVD Silox masking and gaseous diffusion operations specified for forming junctions in the Westinghouse baseline process sequence for producing solar cells from dendritic web silicon were investigated. Author

N83-19222# Photowatt International, Inc., Tempe, Ariz
DEVELOPMENT OF TECHNIQUE FOR AIR COATING AND NICKEL AND COPPER METALIZATION OF SOLAR CELLS Final Report

1982 35 p refs Sponsored in part by DOE Prepared for JPL
 (Contract JPL-955986)
 (NASA-CR-169938, DOE/JPL-955986-4, NAS 1 26 169938)
 Avail: NTIS HC A03/MF A01 CSCL 10A

Solar cells were made with a variety of base metal screen printing inks applied over silicon nitride AR coating and copper electroplated. Fritted and fritless nickel and fritless tin base printing inks were evaluated. Conversion efficiencies as high as 9% were observed with fritted nickel ink contacts, however, curve shapes were generally poor, reflecting high series resistance. Problems encountered in addition to high series resistance included loss of adhesion of the nickel contacts during plating and poor adhesion, oxidation and inferior curve shapes with the tin base contacts. Author

N83-19223# Jet Propulsion Lab., California Inst of Tech., Pasadena.

A SURVEY OF MANUFACTURERS OF SOLAR THERMAL ENERGY SYSTEMS

N. LEVINE and M. SLONSKI Aug 1982 100 p Sponsored by NASA and DOE
 (NASA-CR-169924, JPL-PUB-82-94, JPL-5106-25, DOE/JPL-1060-56; NAS 1 26 169924) Avail: NTIS HC A05/MF A01 CSCL 10A

Sixty-seven firms that had received funding for development of solar thermal energy systems (STES) were surveyed. The effect of the solar thermal technology systems program in accelerating (STES) were assessed. The 54 firms still developing STES were grouped into a production typology comparing the three major technologies with three basic functions. It was discovered that large and small firms were developing primarily central receiver systems, but also typically worked on more than one technology. Most medium-sized firms worked only on distributed systems. Federal support of STES was perceived as necessary to allow producers to take otherwise unacceptable risks. Approximately half of the respondents would drop out of STES if support were terminated, including a disproportionate number of medium-sized

02 SOLAR ENERGY

firms A differentiated view of the technology, taking into account differing firm sizes and the various stages of technology development, was suggested for policy and planning purposes

S L.

N83-19224*# Jet Propulsion Lab., California Inst of Tech., Pasadena

OPTIMIZATION OF DISH SOLAR COLLECTORS WITH AND WITHOUT SECONDARY CONCENTRATORS

L D JAFFE 15 May 1982 130 p refs Sponsored by NASA (Contract DE-AM04-80AL-13137)
(NASA-CR-169928; JPL-PUB-82-103, JPL-5105-113, NAS 1 26 169928, DOE/JPL-1060/57) Avail NTIS HC A07/MF A01 CSCL 10A

Methods for optimizing parabolic dish solar collectors and the consequent effects of various optical, thermal, mechanical, and cost variables are examined The most important performance optimization is adjusting the receiver aperture to maximize collector efficiency. Other parameters that can be adjusted to optimize efficiency include focal length, and, if a heat engine is used, the receiver temperature. The efficiency maxima associated with focal length and receiver temperature are relatively broad; it may, accordingly, be desirable to design somewhat away from the maxima Performance optimization is sensitive to the slope and specular errors of the concentrator Other optical and thermal variables affecting optimization are the reflectance and blocking factor of the concentrator, the absorptance and losses of the receiver, and, if a heat engine is used, the shape of the engine efficiency versus temperature curve. Performance may sometimes be improved by use of an additional optical element (a secondary concentrator) or a receiver window if the errors of the primary concentrator are large or the receiver temperature is high

Author

N83-19225*# Jet Propulsion Lab., California Inst. of Tech., Pasadena

PHOTOVOLTAIC ARRAY: POWER CONDITIONER INTERFACE CHARACTERISTICS

C C GONZALEZ, G M HILL, and R G ROSS, JR 15 Dec 1982 55 p refs Prepared for DOE, Washington, D.C (Contract DE-A101-76ET-20356)
(NASA-CR-169919, JPL-5101-202, JPL-PUB-82-109, DOE/JPL-1012-79, NAS 1 26 169919) Avail NTIS HC A04/MF A01 CSCL 10B

The electrical output (power, current, and voltage) of flat plate solar arrays changes constantly, due primarily to changes in cell temperature and irradiance level As a result, array loads such as dc-to-ac power conditioners must be capable of accommodating widely varying input levels while maintaining operation at or near the maximum power point of the array The array operating characteristics and extreme output limits necessary for the systematic design of array load interfaces under a wide variety of climatic conditions are studied A number of interface parameters are examined, including optimum operating voltage, voltage energy, maximum power and current limits, and maximum open circuit voltage The effect of array degradation and I-V curve fill factor or the array power conditioner interface is also discussed Results are presented as normalized ratios of power conditioner parameters to array parameters, making the results universally applicable to a wide variety of system sizes, sites, and operating modes S L.

N83-19276# New Mexico State Univ., Las Cruces Physical Science Lab

SOLAR THERMOCHEMICAL ENERGY CONVERSION AND TRANSPORT Final Report, 15 Mar. 1977 - 30 Sep. 1982

J. H MCCRARY and G E MCCRARY 10 Nov 1982 40 p (Contract N00014-77-C-0229)
(AD-A121318, NMSU/PSL-PS01010) Avail NTIS HC A03/MF A01 CSCL 10B

The high temperature catalytic dissociation of SO₃ and the CO₂-CH₄ reforming-methanation cycle are important chemical processes being considered in the development and application of solar-thermal energy conversion, transport, and storage systems

Separate facilities for evaluating chemical converter-heat exchangers at temperatures to 1000 C with high flow rates of SO₃ and of mixtures of CO₂ and CH₄ feedstocks have been assembled and operated on the NMSU campus. A number of receiver elements (chemical reactors) have been tested in these laboratory facilities in an effort to optimize catalyst parameters and catalyst reactor configurations These tests led to the design and fabrication of both low power and high power solar energy receivers which were operated successfully at the White Sands solar Furnace Energy delivery methanation reactor design and parametric studies led to the fabrication and operation of laboratory closed-loop, energy conversion, transport, and delivery system. These latter experiments met with limited but promising success. Carbon deposition, though a problem, is believed to be controllable with the optimization of catalyst parameters and feedstock composition. Author (GRA)

N83-19279# Iowa State Univ. of Science and Technology, Ames Inst of Engineering Research

THE RESPONSE OF SOLAR CELLS TO MICROWAVE RADIATION Final Report, 15 Feb. - 15 Sep. 1982

G E FANSLAW Aug 1982 27 p refs
(Contract AF-AFOSR-0200-82; AF PROJ 2306)
(AD-A121813, ISU-ERI-AMES-83057, AFOSR-82-0991TR) Avail NTIS HC A03/MF A01 CSCL 10B

A transmission line analogy is used to show that microwaves would induce little if any voltage in solar cells or solar cell systems. Experimental verification of this result is obtained by irradiating solar cells with microwave energy at 2.45 GHz Results describing the heating of solar cells by microwaves are given, as well as unusual voltages produced in a series combination of solar cells.

R J F

N83-19280# Automation Industries, Inc., Silver Spring, Md
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK

T. T BRADSHAW Dec 1981 132 p
(Contract DE-AC01-79CS-30027)
(DE82-007055, SOLAR/0010-81/12) Avail NTIS HC A07/MF A01

Insolation, temperature, wind, and humidity data for 38 sites in the National Solar Data Network are presented. DOE

N83-19281# Argonne National Lab., Ill
NATIONAL IMPLICATIONS OF SOLAR FUTURES. A TASE PROJECT REPORT

Nov 1981 154 p refs Prepared in cooperation with Brookhaven National Lab., California Univ., Berkeley, Lawrence Berkeley Lab., Los Alamos Scientific Lab., Oak Ridge National Lab., Pacific Northwest Lab and Mitre Corp
(DE82-005122, DOE/EP-0025) Avail NTIS HC A08/MF A01

Two potential solar energy futures for the US in the year 2000 are analyzed and compared in the context of high overall national energy growth (118 quads) which is compatible with the upper range of the National Energy Plan One scenario is a low solar growth scenario wherein solar and biomass technologies contribute the equivalent of 6 quads or 5% to total national energy supply The other scenario is a high solar growth scenario wherein solar and biomass technologies contribute the equivalent of 14.2 quads or 12% of total national energy supply. The results and synthesis of several studies which analyzed and compared the environmental and socioeconomic implications of these potential futures at national, regional, and community levels are presented Detailed discussions of the project itself, the construction of the scenarios, and each analysis contributing to the study are included These analyses are air quality, water quality, water and land resources, indirect emissions, economic, employment, and materials resource, and institutional framework DOE

N83-19283# Boeing Co., Seattle, Wash.
HELIO-THERMICS, INC., LOT NO. 8, SINGLE FAMILY RESIDENCE, GREENVILLE, SOUTH CAROLINA
 D BEERS 26 Mar. 1981 58 p
 (Contract DE-AB01-76CS-31020)
 (DE82-012822, SOLAR/1026-82/50) Avail NTIS HC A04/MF A01

The Helio-Thermics Inc. House Lot No 8 is one of two instrumented single-family residence in Greenville, South Carolina. The home has approximately 1086 square feet of conditioned space. Solar energy is used for space heating and for preheating domestic hot water. The attic space is used as the solar energy collector. It has a 416 square foot aperture and is painted black inside to maximize absorption. Warm air accumulates in the peak of the attic roof and circulates through the conditioned space or through storage by an air handler. Heat is stored in an 870 cubic foot rock bin under the house. Cold water is preheated in the attic by thermosiphoning water from the 82 gallon preheat tank through a manifold system of copper tubes. The instrumentation for the National Solar Data Network is described briefly. Original cost estimates for provisioning and installation of the solar system, with the exception of instrumentation costs, are given. DOE

N83-19285# Advanced Systems Associates, Bloomfield Hills, Mich
DEMONSTRATION OF A SOLAR/WIND-POWERED ELECTROSTATIC-FIELD FOOD-KEEPING DEVICE Final Program Report
 Nov 1981 87 p
 (Contract DE-FG02-80R5-10225)
 (DE82-007971, DOE/RS-10225/T2) Avail. NTIS HC A05/MF A01

Two types of electrostatic power supplies have been studied, breadboarded, and tested for use as electrostatic food keepers. One, an ac system, was designed to be operated from standard 110/120 volt ac household current, and the second was designed to operate from 12 volt dc power supplies, e.g., battery power, solar photovoltaic delivered dc power, or wind generated dc power. The design steps, the bench test experiences and the breadboard system test results obtained during the fifteen month program are reported. Appended are the midterm progress report and the food keeper test records. DOE

N83-19286# Boeing Computer Services, Inc., Seattle, Wash
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE REPORT. VOLUME 5 FOR LOVINGTON SQUARE SHOPPING CENTER, LOVINGTON, NM
 Dec 1981 45 p
 (Contract DE-AC04-76DP-00789)
 (DE82-006877, SAND-81-7085/5) Avail NTIS HC A03/MF A01

For the months of September and October, 1981, operational performance data are presented for a photovoltaic power system at a New Mexico shopping center. The electrical energy yield, incident solar energy, and efficiency of the solar cell array are given, including daily and monthly energy yield and insolation and efficiency, and energy yield as a function of power level, voltage, cell temperature, and hour of the day. Data are presented for two power conditioning units, including power conditioner input, output, and efficiency. The total photovoltaic system efficiency and capacity factor are given as well as daily availability data. Meteorological data include monthly insolation data, heating and cooling degree days, average monthly ambient temperature, monthly average wind speed and distribution of wind directions. Also included are plots of cell temperature, ambient temperature, wind speed, and insolation versus the hour of the day. Also included is a brief narrative description of the system operation and data. DOE

N83-19287# General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept
INITIAL DETAILED DESIGNS FOR INTERMEDIATE PHOTOVOLTAIC SYSTEMS: BRANCH BANK
 G OBRIEN and J. HERZ Dec 1981 194 p refs
 (Contract DE-AC04-76DP-00789)
 (DE82-005854; SAND-81-7178) Avail: NTIS HC A09/MF A01

The first of four detailed PV system designs for intermediate applications with a peak electrical load of 20 to 500 kW is presented. The initial design for a 6 kW direct roof mount, fixed tilt, flat plate array is analyzed for performance and economics. A drawing set, specifications, and installation details are included for procurement and construction bids. DOE

N83-19293# Boeing Computer Services, Inc., Seattle, Wash.
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE REPORT. VOLUME 3. FOR MISSISSIPPI COUNTY COMMUNITY COLLEGE, BLYTHEVILLE, ARKANSAS
 Sep 1982 85 p refs 3 Vol
 (Contract DE-AC04-76DP-00789)
 (DE83-000072; SAND-81-7091/3) Avail NTIS HC A05/MF A01

Presented are the data accumulated during December 1981, January and February 1982 at the intermediate photovoltaic project at Mississippi County Community College, Blytheville, Arkansas. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided. DOE

N83-19295# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
RECEIVER SUBSYSTEM ANALYSIS REPORT (RADL ITEM 4-1). THE 10-MWE SOLAR THERMAL CENTRAL-RECEIVER PILOT PLANT: SOLAR-FACILITIES DESIGN INTEGRATION
 Apr. 1982 633 p refs
 (Contract DE-AC03-79SF-10499)
 (DE83-001638, DOE/SF-10499/T16-REV, SAN-0499-27-REV; MDC-G-8272-REV) Avail NTIS HC A99/MF A01

The results of thermal hydraulic, design for the stress analyses which are required to demonstrate that the receiver design for the Barstow Solar Pilot Plant satisfies the general design and performance requirements during the plant's design life are presented. Recommendations are made for receiver operation. The analyses are limited to receiver subsystem major structural parts (primary tower, receiver unit core support structure), pressure parts (absorber panels, feedwater, condensate and steam piping/components, flash tank, and steam manifold) and shielding. E.A.K.

N83-19296# Georgia Inst of Tech., Atlanta. Engineering Experiment Station
SOLAR-ENERGY TREATMENT OF CERAMIC TILES Final Report
 J. N. HARRIS and M. E. CLAYTON Dec 1981 92 p
 (Contract DE-AC03-81SF-11492)
 (DE83-000147, DOE/SF-11492-T7) Avail. NTIS HC A05/MF A01

The 400 kW Advanced Components Test Facility was used to provide a concentrated source of solar energy for firing ceramic wall tile. A domed top cylindrical cavity with a white refractory fiber lining provided diffuse reflection of the concentrated solar beam directly onto the upper surface of the unfired wall tile. The tile were placed directly on the cavity floor in a circular pattern, centered at 450 intervals so that eight tile could be fired at one time. The tile and cavity walls were instrumented with thermocouples, and pyrometric cones were used to determine temperature distribution within the cavity. The glazed and unglazed solar fired tiles were tested for flatness, modulus of rupture, water absorption, porosity, bulk density, apparent specific gravity, percent linear thermal expansion and crystalline phases present in the fired bodies. The major problems encountered are cracking by thermal shock, and uneven shrinkage and glaze maturity across

02 SOLAR ENERGY

individual tile The cavity failed to provide even heating at all eight tile positions DOE

N83-19297# Brookhaven National Lab., Upton, N Y Dept of Energy and Environment

STEADY-STATE TESTING OF AN ADVANCED SOLAR-ASSISTED HEAT PUMP

M A. CATAN Jun 1982 18 p refs

(Contract DE-AC02-76CH-00016)

(DE83-002343, BNL-51564) Avail NTIS HC A02/MF A01

A prototype water to air solar assisted heat pump (SAHP) was tested under steady state conditions It is indicated that the nominal goal for the hardware portion of the contract was achieved and surpassed The tests show some areas of potential improvement, which are discussed DOE

N83-19303# Southern Solar Energy Center, Inc., Atlanta, Ga. **ECONOMIC FEASIBILITY OF SOLAR THERMAL INDUSTRIAL APPLICATIONS AND SELECTED CASE STUDIES**

A MONTELLIONE, D BOYD, and M. BRANZ Dec 1981 57 p refs

(Contract DE-AC02-79CS-30166)

(DE82-009503, SSEC/TP-31298) Avail NTIS HC A04/MF A01

The economic feasibility is assessed of utilizing solar energy to augment an existing fossil fuel system to generate industrial process heat Several case studies in the textile and food processing industries in the southern United States were analyzed Sensitivity analyses were performed, and comparisons illustrating the effects of the Economic Recovery Tax Act of 1981 were made The economic desirability of the proposed solar systems varied with the type of system selected, location of the facility, state tax credits, and type of fuel displaced For those systems presently not economical, the projected time to economic feasibility was ascertained DOE

N83-19312# Thermo Electron Corp., Waltham, Mass **THE DEVELOPMENT OF SOLAR-ASSISTED GAS-FIRED APPLIANCES, PHASE 2 Final Report, Dec. 1980 - Nov. 1981**

K G. HAGEN, A. LEVINE, J M COLARUSSO, and A I ZAKAK Dec 1981 215 p refs

(PB82-231663, GRI-81/0017, TE4274-160-82) Avail NTIS HC A10/MF A01 CSCL 10A

An evaluation of applying solar assistance to commercial laundry drying and supermarket dehumidification was accomplished. The laundry drying project included experimental evaluation of the transient and steady-state characteristics of the hot air produced by an air-heating solar collector, experimental evaluation of the performance characteristics of a gas-fired laundry dryer as affected by varying the inlet air temperature and humidity; and an assessment of the characteristics of commercial laundries in relation to the potential commercialization of the solar-assisted dryer concept The supermarket dehumidification project included an assessment of the relative latent and sensible cooling requirements as a function of geographic location GRA

N83-19330# Energy Utilization Systems, Inc., Pittsburgh, Pa **1980 SURVEY AND EVALUATION OF UTILITY CONSERVATION, LOAD MANAGEMENT AND SOLAR END-USE PROJECTS. VOLUME 2: SOLAR END-USE PROJECTS Final Report**

Jan 1982 422 p Sponsored by EPRI

(Contract EPRI PROJ 1940-1)

(DE82-901849, EPRI-EM-2193-VOL-2) Avail NTIS HC A16/MF A01

The results are described of the 1980 survey of electric utility sponsored end-use solar energy conversion projects The results of an extensive survey to determine electric utility involvement in customer side projects related to solar technology, selected descriptions of utility projects and results, and first level technical and economic evaluations are presented DOE

N83-19567# Max-Planck-Institut fuer Aeronomie, Kallenburg-Lindau (West Germany)

OPTICAL MEASUREMENTS [OPTISCHE MESSUNGEN]

W A MATTHEWS *In its Simultaneous Meas of Trace Gas by Microwaves, Opt and Chem Methods* p 46-60 Jul 1982 refs In GERMAN

Avail NTIS HC A06/MF A01

The scanning filter photometer and heliostat are described Solar spectra in the ultraviolet zone between 300 and 350 nm and in the visible area between 430 and 460 nm were observed by scanning filter photometers The absorption coefficient of the atmospheric component and NO₂ changes remarkably with the wavelength in this zone, and the so called double differential absorption process allows interference on the atmospheric contents of both components An automatic solar control conducts the sunlight into possible changes of the full azimuth angles The sunlight is conducted into the airplane and split into two parts in which the intensity of such a ray is registered by a photomultiplier The photomultiplication flow is digitalized in the wavelength dependent channel Transl by E.A K

N83-19627# California Univ., Berkeley Lawrence Berkeley Lab. Chemical Biodynamics Div

PHOTO-INDUCED ELECTRON-TRANSFER REACTIONS IN HETEROGENEOUS MEDIA Ph.D. Thesis

J M YANG Nov. 1981 229 p refs

(Contract W-7405-ENG-48)

(DE82-005767, LBL-13650) Avail NTIS HC A11/MF A01

The conversion of solar energy into chemical energy was pursued by two approaches One is the photo-induced electron transfer reactions in heterogeneous media, and the other is the photo-decomposition of water with liquid-junction solar cells Photo-induced electron-transfer reactions in heterogeneous media with colloidal silica or poly-acrylate were studied by flash photolysis. In an effort to illustrate that small band-gap semiconductors can be protected from photo-corrosion through surface modification, the surface of polycrystalline ZnO was chemically coated with zinc phthalocyanine and the electron-transfer process across the coated ZnO-electrolyte interface was studied by photo-electrochemical techniques DOE

N83-19781# Jet Propulsion Lab., California Inst of Tech., Pasadena DSN Engineering Office

PERFORMANCE SIMULATION OF THE JPL SOLAR-POWERED DISTILLER. PART 1: QUASI-STEADY-STATE CONDITIONS

C S YUNG and F L LANSING *In its The Telecommun and Data Acquisition Rept* p 142-160 15 Feb 1983 refs

Avail NTIS HC A11/MF A01 CSCL 10A

A 37.85 cu m (10,000 gallons) per year (nominal) passive solar powered water distillation system was installed and is operational in the Venus Deep Space Station The system replaced an old, electrically powered water distiller The distilled water produced with its high electrical resistivity is used to cool the sensitive microwave equipment A detailed thermal model was developed to simulate the performance of the distiller and study its sensitivity under varying environment and load conditions The quasi-steady state portion of the model is presented together with the formulas for heat and mass transfer coefficients used Initial results indicated that a daily water evaporation efficiency of 30% can be achieved A comparison made between a full day performance simulation and the actual field measurements gave good agreement between theory and experiment, which verified the model S L

N83-19898# Sandia Labs., Albuquerque, N Mex.

THERMAL-CONVECTIVE-LOOP CORRECTION TESTS OF 316SS AND IN800 IN MOLTEN NITRATE SALTS

R W BRADSHAW Feb 1982 31 p refs

(Contract DE-AC04-76DP-00789)

(DE82-012313, SAND-82-8210) Avail NTIS HC A03/MF A01

The corrosion behavior of Type 316 stainless steel and Incoloy 800 in molten NaNO₃-KNO₃ was studied using thermal convection loops which operated between the temperature limits, 630 C to 350 C, for up to 4000 hours. Corrosion rates were approximately

1 mil/year at 600 C for 316SS but increased to about 4 mil/year at 630 C. Less extensive results are reported for IN800 but the corrosion rates appear to be similar to 316SS. Corrosion products consisted of the spinels, Fe_3O_4 and $\text{Fe}(\text{Fe},\text{Cr})_2\text{O}_4$, at temperatures below 600 C, although NaFeO_2 and $\text{Fe}(\text{Fe},\text{Cr})_2\text{O}_4$ were present at higher temperatures. In addition, internal oxide penetration was observed in IN800. Considerable spalling of surface scales was found at temperatures above 600 C and a mass balance was developed to estimate total corrosion rates from weight change and metallographic data. Chromium, but not iron or nickel, accumulated as a solute in the melt as a result of depletion from the alloys, but no thermal gradient mass transfer was detected.

DOE

N83-19917# Massachusetts Inst of Tech, Cambridge Energy Lab

GRADED-INDEX ANTIREFLECTIVE COATINGS FOR GLASS Final Report, Sep. 1978 - Feb. 1982

J S HAGGERTY Apr. 1982 181 p refs

(Contract DE-AC02-78ER-05003)

(DE82-016756, DOE/ER-05003/016, MIT-EL-82-016) Avail: NTIS HC A09/MF A01

Glass compositions and process conditions by which broad band graded-index antireflective films can be produced on glass surfaces have been developed. The end use for the treated glass sheet is as cover plates for flat plate solar-thermal collectors, thus, cost issues dictated that the process conditions fall within constraints imposed by the float glass process. To accomplish this objective, both the film formation process and the characteristics of the graded-index films were investigated in detail. A model borosilicate glass was used for initial work that served to verify experimental procedures, to confirm essential features of the film forming process and to determine whether the porous surface film and the phase separated structure of the host glass had an adverse effect on mechanical properties. Based on the results with the borosilicate glass, a candidate soda-lime-silica glass composition was defined that satisfied the phase separation and float glass process criteria.

DOE

N83-19962# Swedish Council for Building Research, Stockholm
SURVEY OF THE INTERNATIONAL DEVELOPMENT IN INDOOR CLIMATE CONTROL

B LEVIN 1982 85 p refs

(PB83-100461; ISBN-91-540-3709-3, D8 1982) Avail: NTIS HC A05/MF A01 CSCL 13A

A survey of research in indoor climate control is presented. There are a number of research projects concerning improvement of HVAC-unit control. Only projects concerning the improvement of automatic control were selected.

GRA

N83-19963# AiResearch Mfg Co., Torrance, Calif.
SOLAR/GAS BRAYTON/RANKINE CYCLE HEAT PUMP ASSESSMENT Final Report, Apr. 1981 - May 1982

J ROUSSEAU and A Y LIU May 1982 102 p

(PB83-102319; GRI-80/0138) Avail: NTIS HC A06/MF A01 CSCL 13A

A 10-ton gas-fired heat pump is currently under development at AiResearch under joint DOE and GRI sponsorship. This heat pump features a highly efficient, recuperated, subatmospheric Brayton-cycle engine which drives the centrifugal compressor of a reversible vapor compression heat pump. The investigations under this program were concerned initially with the integration of this machine with a parabolic dish-type solar collector. Computer models were developed to accurately describe the performance of the heat pump packaged in this fashion. The study determined that (1) only a small portion (20 to 50 percent) of the available solar energy could be used because of a fundamental mismatch between the heating and cooling demand and the availability of solar energy, and (2) the simple pay back period, by comparison to the baseline non-solar gas-fired heat pump, was unacceptable (15 to 36 years).

GRA

N83-20298# AiResearch Mfg Co., Torrance, Calif

ANALYSIS OF THERMAL AND MECHANICAL STRESSES IN THE CERAMIC SEAL OF THE 1-MW(TH) BENCH MODEL SOLAR RECEIVER Final Report

Feb. 1982 192 p refs Sponsored by EPRI

(Contract EPRI PROJ 475-9)

(DE82-901870, EPRI-AP-2267) Avail: NTIS HC A09/MF A01

The thermal/mechanical stress levels associated with the hot tube to manifold ceramic joint for the 1-Mw/sub t/ bench model solar receiver (BMSR) was discussed and appropriate design and/or material changes for this joint were determined to provide an acceptably low probability of failure. To this end, thermal shock/thermal gradient and combined thermal/mechanical loading tests were designed, analytically modeled, experimentally carried out, and subsequently analyzed. Analysis of the BMSR ceramic joint design and materials revealed that a rather low probability of success would be expected. From the experiments performed, it was deduced that the current disc material has an apparent Weibull modulus of three to five for the Si_3N_4 discs and slightly greater than ten for the SiC discs. The thermal resistance at the tube/disc interface was found to decrease significantly with the increased surface contact area due to hand lapping the tube into the disc seat.

DOE

N83-20360# Rockwell International Corp., Pittsburgh, Pa
Satellite Systems Div.

LOW CONCENTRATION RATION SOLAR ARRAY FOR LOW EARTH ORBIT MULTI-100 KW APPLICATION Mid-term Report

S. J NALBANDIAN Nov. 1982 146 p refs

(Contract NAS8-34214)

(NASA-CR-170729, NAS 1 26.170729; SSD82-0172) Avail:

NTIS HC A07/MF A01 CSCL 10A

An ongoing preliminary design effort directed toward a low-concentration-ratio photovoltaic array system based on 1984 technology and capable of delivering multi-hundred kilowatts (300 kW to 1000 kW range) in low earth orbit is described. The array system consists of two or more array modules each capable of delivering between 80 kW to 172 kW using silicon solar cells or gallium arsenide solar cells respectively. The array module deployed area is 1320 square meters and consists of 4356 pyramidal concentrator elements. The module, when stowed in the Space Shuttle's payload bay, has a stowage volume of a cube with 3.24 meters on a side. The concentrator elements are sized for a geometric concentration ratio (GCR) of six with an aperture area of 0.5 meters x 0.5 meters. The structural analysis and design trades leading to the baseline design are discussed. The configuration, as well as optical, thermal and electrical performance analyses that support the design and overall performance estimates for the array are described.

Author

N83-20362# Delaware Univ., Newark Dept of Electrical Engineering

DESIGN RULES FOR A 100X MAXIMUM EFFICIENCY GAAS CONCENTRATOR SOLAR CELL FOR SPACE APPLICATIONS Final Report

A. N. BARNETT 22 Mar. 1983 15 p refs

(Contract NAG3-321)

(NASA-CR-170005; NAS 1.26 170005) Avail: NTIS HC A02/MF A01 CSCL 10A

The preference of N on P as the preferred structure rather than the common P on N structure, the design of an improved transparency top contact based on the separation of the grid and bus bars, and the identification of gallium phosphide as an improved window layer, replacing the (GaAl) are investigated.

Author

02 SOLAR ENERGY

N83-20374*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio

SCREEN PRINTED INTERDIGITATED BACK CONTACT SOLAR CELL Patent Application

C. R. BARAONA, G. A. MAZARIS, and A. T. CHAI, inventors (to NASA) 10 Feb. 1983 8 p
(NASA-CASE-LEW-13414-1, US-PATENT-APPL-SN-465364)
Avail NTIS HC A02/MF A01 CSCL 10A

Interdigitated back contact solar cells were made by screen printing dopant materials onto the back surface of a semiconductor substrate in a pair of interdigitated patterns. These dopant materials were then diffused into the substrate to form junctions having configurations corresponding to these patterns. Contacts having configurations which match the patterns were then applied over the junctions
NASA

N83-20377# Oak Ridge National Lab., Tenn. Research and Renewables Research Section.

ANNUAL CYCLE ENERGY SYSTEM PERFORMANCE AND NATIONAL ECONOMIC COMPARISONS WITH COMPETITIVE RESIDENTIAL HVAC SYSTEMS

V. D. BAXTER 1982 16 p refs Presented at the Semiannual Meeting of the American Society of Heating, Refrigerating, and Air Conditioning Engineers, Houston, Tex., 24 Jan 1982
(Contract W-7405-ENG-26)
(DE82-010188, CONF-820112-6) Avail: NTIS HC A02/MF A01

The results of three years of experience with the Annual Cycle Energy System (ACES) and conventional systems in two identical houses, the ACES house (using an ACES for heating, cooling, and water heating) and the control house (using conventional systems). The houses, located in a test complex on the University of Tennessee campus at Knoxville, Tennessee were unoccupied during the tests. Internal loads for a family of four were simulated by appliances and hot water used at the rate of 265 L/d (70 gal/d). The test period extended from November 1, 1977 through September 15, 1980. Additionally the results of an analytical study comparing the ACES performance and economics with that of several conventional heating, ventilating, and air conditioning (HVAC) and water heating systems are summarized
DOE

N83-20381# Solar Business Office, Sacramento, Calif Business and Transportation Agency

SOLAR FOR INDUSTRY Final Report

15 Apr. 1980 52 p refs Presented at a seminar on Solar for Ind., Los Angeles, 22 Feb. 1980, and at San Francisco, 21 Mar 1980
(Contract DE-FG03-79CS-30284)
(DE83-003301, DOE/CS-30284/T2) Avail: NTIS HC A04/MF A01

Two seminars on Solar for Industry were held. An agenda, feedback, lists of attendees and invitees, and a published article are provided. Also provided is a conference packet, including a questionnaire and original materials used. The conferences are evaluated and follow-up efforts are listed.
DOE

N83-20382# Massachusetts Inst of Tech., Cambridge
CHALCOGENIDE-GLASS SOLAR CELLS Quarterly Technical Report, 1 Jan. - 31 Mar. 1980

D. ADLER and J. S. HAGGERTY 1980 30 p
(Contract DE-AC03-79ET-23043)
(DE82-021243, DOE/ET-23043/T2, QTR-2) Avail: NTIS HC A03/MF A01

Several disadvantages of chalcogenide glasses for solar cell applications are studied to determine if they can be overcome by chemical modification. These problems include a pinned Fermi energy, low carrier lifetime, and the presence of geminate recombination for photon frequencies just above the optical bandgap which reduces the overall quantum efficiency. Emphasis is on the selenium-tellurium system. The tasks reported were: to try to overcome the transient effects by stabilizing the glass with a modifier such as arsenic, to reactively sputter the glass in hydrogen/argon mixtures to ascertain whether the introduction of hydrogen would serve to reduce the defect density, and to cosputter

the glass with lithium in an attempt to unpin the Fermi energy of the glass and obtain a low resistance back contact for solar cells. Stabilization was accomplished with only 1% arsenic. It is found that hydrogenation increases the resistance somewhat and leads to non-ohmic behavior at a lower applied field; however the photoconductivity and the spectral response of the photocurrent are degraded
DOE

N83-20384# Arizona Public Service Co., Phoenix.

AIRPORT SOLAR PHOTOVOLTAIC CONCENTRATOR Project Status Report, 1 Jul. - 31 Oct. 1982

1982 9 p
(Contract DE-AC04-80ET-20624)
(DE83-003137, DOE/ET-20624/T1, ASPCP-111-1) Avail: NTIS HC A02/MF A01

The operation and evaluation at the Phoenix Sky Harbor International Airport Van 80-array photovoltaic power supply rated at 225 kW is reported. Problems with acquiring array performance data due to a malfunction of the tester are reported. System availability and energy production and usage data are listed, as is the distribution of system downtime. System operation and maintenance efforts are reported. The data acquisition system data are compared to other similar data for correlation. System performance is reported to be good, and about 320,000 kWh are expected for the first year's operation.
DOE

N83-20387# Sandia Labs., Albuquerque, N. Mex.

PHOTOVOLTAIC-CONCENTRATOR TECHNOLOGY IN THE USA

E. C. BOES and M. W. EDENBURN 1982 6 p refs Presented at 4th Photovoltaic Solar Energy Conf., Stresa, Italy, 10 May 1982
(Contract DE-AC04-76DP-00789)
(DE82-016399, SAND-82-1154C, CONF-820555-4) Avail: NTIS HC A02/MF A01

One of the alternate electrical energy technologies that has progressed most rapidly over the past several years is photovoltaic concentrator technology. In the US, with funding of approximately \$40 million over the past 7 years, this solar electric technology has been transferred from the conceptual stage to the point where several promising designs have been fabricated and tested. The experience of concentrator research and development thus far strongly supports the initial hope that it could be a practical alternative to flat plate photovoltaics. PV concentrators are far more efficient than flat plate PV modules. Designing PV concentrators with 20 year lifetimes appears feasible. Totally installed PV concentrator array costs are projected to reach \$1 to \$2 per peak watt. Fresnel lens concentrators using planar junction Si cells have already achieved measured annual average efficiencies of 13 to 14%, and well understood modifications will increase this to the 15 to 16% range. More advanced module designs have been measured at as high as 20%.
DOE

N83-20388# Sandia Labs., Albuquerque, N. Mex.

DESIGN, TESTING, AND ECONOMICS OF A 430 W SUB P PHOTOVOLTAIC CONCENTRATOR ARRAY FOR NON GRID-CONNECTED APPLICATIONS

A. MAISH, M. RIOS, JR., and H. TOGAMI 1982 6 p refs Presented at Am. Section of the Intern. Solar Energy Soc. Conf., Houston, Tex., 1 Jun 1982
(Contract DE-AC04-76DP-00789)
(DE82-014687, SAND-82-0957C, CONF-820629-9) Avail: NTIS HC A02/MF A01

A stand-alone 430 W/sub p/ photovoltaic (PV) concentrating system for low power, non grid-connected applications has been designed, fabricated, and tested at Sandia National Laboratories. The array consists of four passively cooled Fresnel lens concentrating modules on a newly developed polar axis tracking structure. Two axis tracking is provided using a self powered clock drive unit mounted on a single post foundation. Test results of tracking accuracy, array output power, parasitic power, performance in winds and array reliability are discussed using a range of estimated production costs for small production volumes, the life-cycle energy costs have been calculated and compared to

the equivalent energy costs of a 3 kW diesel electric generator set and of an equivalent flat panel PV system DOE

N83-20389# Arkansas Univ., Fayetteville
ANALYSIS OF TEMPERATURE DATA FROM MARTIN MARIETTA SOLAR PHOTOVOLTAIC ARRAY
 F K. DEEVER Feb. 1982 25 p refs
 (Contract DE-AC04-76DP-00789)
 (DE82-014258, SAND-81-7177) Avail: NTIS HC A02/MF A01

Solar photovoltaic cells in a concentrating array absorb thermal energy which must be removed to maintain the cells at an optimum operating temperature. One method of removing the heat is by mounting the cells on finned aluminum heat exchangers. In order to model the performance of such a heat exchange, an estimate of the overall heat transfer coefficient between the finned surface and the surroundings is needed. This coefficient is dependent on wind speed, wind direction, heat exchanger design, orientation of the array, and other parameters. Data for several such heat exchangers on a Martin Marietta concentrating photovoltaic array were obtained. A transient analytical model of the heat exchanger was applied to the experimental data from three different modules. Overall coefficients of heat transfer from the exchanger were calculated and correlations of these coefficients with wind speed and direction were attempted. DOE

N83-20390# Varian Associates, Palo Alto, Calif Solid State Lab
ACCELERATED AGING OF GAAS CONCENTRATOR SOLAR CELLS

P E GREGORY Apr 1982 147 p refs
 (Contract DE-AC04-76DP-00789)
 (DE82-016658, SAND-81-7112) Avail: NTIS HC A07/MF A01

An accelerated aging study of AlGaAs/GaAs solar cells was completed. The purpose was to identify the possible degradation mechanisms of AlGaAs/GaAs solar cells in terrestrial applications. Thermal storage tests and accelerated AlGaAs corrosion studies were performed to provide an experimental basis for a statistical analysis of the estimated lifetime. Results of this study suggest that a properly designed and fabricated AlGaAs/GaAs solar cell can be mechanically rugged and environmentally stable with projected lifetimes exceeding 100 years. DOE

N83-20391# Boeing Computer Services, Inc., Seattle, Wash
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE REPORT. VOLUME 6: BEVERLY HIGH SCHOOL, BEVERLY, MASS. Monthly Report

Mar 1982 26 p
 (Contract DE-AC04-76DP-00789)
 (DE82-014710, SAND-81-7088-6) Avail: NTIS HC A03/MF A01

Performance data are given for the month of February, 1982 for a photovoltaic power supply at a Massachusetts high school. Data given include monthly and daily electrical energy yield, monthly and daily insolation, monthly and daily array efficiency, energy production as a function of power level, voltage, cell temperature, and hour of day, insolation as a function of hour of the day, input, output and efficiency for each of two power conditioning units and for the total power conditioning system, energy supplied to the load by the photovoltaic system and by the grid, photovoltaic system efficiency, dollar value of the energy supplied by the photovoltaic system, capacity factor, daily photovoltaic energy to load, daily system availability and hours of daylight, heating and cooling degree days, hourly cell temperature, ambient temperature, wind speed, and insolation, average monthly wind speed, wind direction distribution, and daily data acquisition mode and recording interval plot. DOE

N83-20392# Bechtel Corp., San Francisco, Calif. Research and Engineering Operation
PHOTOVOLTAIC SUBSYSTEM OPTIMIZATION AND DESIGN TRADEOFF STUDY Final Report

W J. STOLTE Mar 1982 430 p refs
 (Contract DE-AC04-76DP-00789)
 (DE82-013393, SAND-81-7013) Avail: NTIS HC A19/MF A01

Tradeoffs and subsystem choices are examined in photovoltaic array subfield design, power conditioning sizing and selection, roof and ground mounted structure installation, energy loss, operating voltage, power conditioning cost, and subfield size. Line and self-commutated power conditioning options are analyzed to determine the most cost effective technology in the megawatt power range. Methods for reducing field installation of flat panels and roof mounting of intermediate load centers are discussed, including the cost of retrofit installations. DOE

N83-20393# Sandia Labs, Albuquerque, N. Mex.
PHOTOVOLTAIC RETROFIT FEASIBILITY IN THE UNITED STATES

J L. JACKSON 1982 10 p refs Presented at the 4th Photovoltaic Solar Energy Conf., Stressa, Italy, 10 May 1982
 (Contract DE-AC04-76DP-00789)
 (DE82-014508, SAND-81-2081C; CONF-820555-1) Avail: NTIS HC A02/MF A01

Residential and commercial retrofits may represent a significant US national market for photovoltaic (PV) systems. Techniques for estimating this market are estimated and conclusions about physical market size are presented. Possible PV retrofitting techniques for residential and commercial structures are discussed. DOE

N83-20394# General Electric Co., Philadelphia, Pa General Electric Energy Systems and Technology Div
DESIGN OF A PHOTOVOLTAIC SYSTEM FOR A SOUTHEAST ALL-ELECTRIC RESIDENCE

E M. MEHALICK, G F. TULLY, J JOHNSON, N TRUNCCELLITO, R SCHAEFFER, and J PARKER Jan 1982 156 p refs
 Prepared in cooperation with Sandia National Lab., Albuquerque, N. Mex.

(Contract DE-AC04-76DP-00789)
 (DE82-009349; SAND-80-7172) Avail: NTIS HC A08/MF A01

A photovoltaic system was developed and integrated into a single-story residence suitable for the Southeast region of the country. The design addresses an integral mounted array which displaces conventional roof sheathing, roofing felt and shingles. The array has a rated power output of 5.6 kW and covers 86 sq m of roof area. A 6 kW utility-tied inverter is used in the power conversion subsystem, representative of a lower cost version, currently available hardware. The system provides feedback of excess energy to the utility, which is the most promising approach for grid-connected systems in the mid-1980's. The complete system and house design are described, including all the pertinent installation and construction drawings. Specific performance results are presented for the Miami, Florida, and Charleston, SC, regions. DOE

N83-20396# General Electric Co., Philadelphia, Pa Energy Systems and Technology Div
INITIAL DETAILED DESIGNS FOR INTERMEDIATE PHOTOVOLTAIC SYSTEMS: WAREHOUSE

J HERZ and G OBRIEN Feb 1982 221 p refs
 (Contract DE-AC04-76DP-00789)
 (DE82-014534, SAND-81-7189) Avail: NTIS HC A10/MF A01

This initial design for a 30 kW ground mounted, 2-axis tracking concentrator is analyzed for performance and economics. A drawing set, specifications, and installation details are included for procurement and construction bids. DOE

02 SOLAR ENERGY

N83-20397# Battelle Columbus Labs., Ohio
DESIGN AND MARKET STUDY OF PHOTOVOLTAIC SYSTEMS FOR COMMERCIAL BUILDING AND APPLICATIONS. VOLUME 3: APPENDICES

G. T. NOEL, J. R. HAGELY, and J. H. BROEHL Mar. 1982
219 p refs Prepared in cooperation with Sandia National Lab., Albuquerque, N. Mex.
(DE82-016729; SAND-81-7179/3-APP-VOL-3) Avail NTIS HC A10/MF A01

Details of the methodologies and analyses used in developing the results of the design and market study are given. They include: definition of commercial and institutional buildings in terms of the standard industrial classification code, distribution of roof area by building type and region; building characteristics of roof area by building and region, building characteristics survey forms; list of individuals and firms participating in building characteristics survey, by region; selected building characteristics and level of retrofit difficulty, modular design for low-cost flat-panel photovoltaic array fields, life-cycle cost and financial analyses, portions of California and Western Texas included in the Southwest Region market assessments, photovoltaic module specification, and an example photovoltaic applications systems analysis printout DOE

N83-20398# Advanced Technology, Inc., McLean, Va
PHOTOVOLTAIC OFF-FARM AGRICULTURAL APPLICATIONS. VOLUME 1: EXECUTIVE SUMMARY Final Report

W. F. ADOLFSON Feb 1982 49 p refs Prepared in cooperation with Sandia National Lab., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE82-008487; SAND-81-7175/1-VOL-1) Avail NTIS HC A03/MF A01

The major off farm agricultural applications and photovoltaic system options available for supplying electricity and low temperature heat required by these industries are highlighted. The off farm agricultural industry, which includes food processing, agricultural chemicals, tobacco and alcohol fuels, consumes about 2 percent of the United States energy supply for direct heat and mechanical power. Photovoltaic energy systems can cut energy costs in many of these industrial applications, although early market penetration may be hampered by certain market barriers DOE

N83-20401# Wisconsin Univ., Madison Solar Energy Lab
SIMULATION AND DESIGN OF PASSIVE PROCESSES Progress Report, 15 Aug. 1981 - 15 Feb. 1982

26 Feb. 1982 40 p refs
(Contract DE-FG02-81CS-30634)
(DE82-016647; DOE/CS-30634/1) Avail NTIS HC A03/MF A01

Two major parts of the research reported concern: (1) modeling and design of passive processes, and (2) study of meteorological data to make it useful in evaluating and designing passive processes. Results of the first two quarters of this work include development and exercise of a sunspace model, and conduct of a first sensitivity study of sunspace design factors, development of a subroutine for calculating effects of ground coupling on performance of basements, earth sheltered buildings and buried tanks, publication of preprocessed meteorological data useful in calculation of passive heating performance by anti theta methods; and development of correlations for degree days for various base temperatures and times of day from monthly average temperatures and solar radiation DOE

N83-20402# Burt, Hill, Kosar, Rittleman and Associates, Washington, D.C.
PERFORMANCE EVALUATION MANUAL FOR SUBMETERED DATA COLLECTION

Jan 1982 160 p
(Contract DE-AC02-81CS-30632)
(DE82-011223; DOE/CS-30632/3) Avail NTIS HC A08/MF A01

Forms and procedures are given and explained for reporting performance data including: auxiliary energy used for space heating and cooling and domestic hot water, energy used for lighting and

miscellaneous applications, environmental control set points for heating, cooling, and economizer operation, site weather data, and fuel costs. Three forms are proposed. The first, for one time measurements, consists primarily of the architects' assumptions regarding building use, estimates of anticipated performance, and performance specifications of installed equipment. The second form is used to collect data weekly, and is designed to organize information for preparing the monthly report. The third form, the monthly report, summarizes the data collected throughout the month and compares these data with those predicted at the start of the program. Tables specifying the thermal and occupant data measurements to be collected and analyzed are presented along with explanatory notes for each DOE

N83-20404# Midwest Research Inst., Golden, Colo Solar Thermal Engineering Branch.

FLOW INSTABILITY DURING DIRECT STEAM GENERATION IN A LINE-FOCUS SOLAR-COLLECTOR SYSTEM

R. J. PEDERSON and E. K. MAY Mar 1982 31 p refs
Sponsored in part by the American Society of Engineering Education
(Contract DE-AC02-77CH-00178; EG-77-C-01-4042)
(DE82-012887; SERI/TR-632-1354) Avail NTIS HC A03/MF A01

The problem of two phase flow instability as applied to the direct generation of steam in a parallel channel, line focus solar system is addressed. Five types of flow instability were identified as being potentially harmful to the operation of the system. The basic mechanism contributing to these instabilities and the criteria used to predict their onset are discussed. The criteria are presented in two generalized maps which can be used for steady as well as transient operation. It is shown that the system considered can be made to operate in a stable manner with only minor modification. DOE

N83-20407# Chronar Corp., Princeton, N.J.
SEMICONDUCTING POLYACETYLENE MATERIALS FOR ENERGY-CONVERSION APPLICATIONS Final Report

Z. KISS and B. WEINBERGER 25 Mar. 1982 20 p refs
(Contract DE-AC02-79ER-10519)
(DE82-012320; DOE/ER-10519/T1) Avail NTIS HC A02/MF A01

Well controlled growth of semiconducting polyacetylene films by the Ziegler catalyst method was achieved. Thermal isomerization to the trans-(CH)_x/stage has yielded (CH)_x/films of p-type doping with an acceptor concentration of 10 to the sixteenth to 10 to the 17th power cm⁻³. Initial proof of concept experiments were also performed to grow polyacetylene by a plasma assisted process. The band edge of (CH)_x/ was measured. The technique consisted of measuring the photoresponse of a reverse biased (CH)_x/ solar cell, and studying the cut off in the response. The (CH)_x/ films had a band gap in the range of 1.4 to 1.5 eV, in good agreement with the measurement of absorption. A very important result of the successful demonstration of this technique is that very low absorption coefficients can be measured quite easily, yielding invaluable data on band tails in (CH)_x/ DOE

N83-20408# Solamat, Inc., East Providence, R.I.
RESEARCH ON APPLICATION OF ARC-PLASMA SPRAYING (APS) Final Report, 18 Sep. 1978 - 28 Feb. 1982

M. C. NARASIMHAN, J. J. LOFFERSKI, B. ROESSLER, L. B. FREUND, J. PIEKOSZEWSKI, and T. RUSSELL 8 Apr 1982
165 p refs
(Contract DE-AC02-78ER-04749)
(DE82-015220; DOE/ER-04749/T1) Avail NTIS HC A08/MF A01

The work described is aimed at applying arc plasma spraying (APS) to three solar energy applications, namely fabrication of silicon solar cells from polycrystalline silicon layers deposited by arc plasma spraying on suitable substrates, preparation of selective absorber surfaces for solar thermal energy absorbers by arc plasma spraying semiconductors over metal (aluminum, steel, etc.)

substrates, and fabrication of inexpensive, durable ohmic contacts to single crystal and polycrystalline solar cells by arc plasma spraying appropriate metals and alloys onto both the light receiving and back surfaces of the photovoltaic device. To summarize briefly, the most successful of the three activities was that aimed at making ohmic contacts by arc plasma spraying, it requires additional work to establish commercial viability, but its technical feasibility has been demonstrated DOE

N83-20409# Midwest Research Inst., Golden, Colo Solar Energy Research Inst

SOLAR ELECTRIC TECHNOLOGIES: METHODS OF ELECTRIC UTILITY VALUE ANALYSIS

J. R HARPER and C D PERCIVAL May 1982 72 p refs
(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE82-014285, SERI/TR-214-1362) Avail NTIS HC A04/MF A01

Methods are described for determining the financial value of solar-electric technologies to electric utilities The methods are performed by packages of computer models available from SERI that can be interfaced with most conventional utility planning methods The output of these models gives a financial break-even value (\$/ kW) of the solar-electric system under consideration in the specific utility systems General descriptions of the value methods for wind, solar thermal electric, photovoltaic, base load solar (OTEC and biomass) load management, and conservation technologies are included DOE

N83-20410# Washington Resources, Inc., Washington, D.C.
ANALYSIS OF THE ECONOMICS OF TYPICAL BUSINESS APPLICATIONS OF SOLAR ENERGY

11 Nov 1981 59 p
(Contract DE-FG02-77CS-34103)
(DE82-013419, MASEC-SCR-81-093) Avail NTIS HC A04/MF A01

An economic analysis is provided of flat plate collector systems in industrial, commercial, and agricultural business applications in a variety of locations A key element of the analysis is the federal solar investment tax credit The SOLCOST Solar Energy Design Program is used for the study The differences between industrial agricultural and commercial applications are considered, as are finance and tax data and fuel data The rate of return and payback are the criteria used to compare the economic viability of systems Market penetration estimates for process steam were derived for seven southwestern states where direct solar radiation is highest DOE

N83-20416# Lincoln Lab, Mass Inst of Tech, Lexington
PHOTOVOLTAIC/THERMAL COLLECTOR DEVELOPMENT PROGRAM Final Report

S D HENDRIE Mar. 1982 115 p refs
(Contract DE-AC02-76ET-20279)
(DE82-012572, DOE/ET-20279/168) Avail NTIS HC A06/MF A01

The development of combined photovoltaic/thermal (PV/T) collectors began with the testing of commercially produced air and liquid PV/T prototype units and culminated in a second generation of collector units Both air-and liquid-type collectors were developed as part of the second-generation effort A number of concept designs, including a two phase flow and an unglazed PV/T unit, were also studied The results of early collector testing and the design of the second-generation units are detailed Performance results for second-generation units are included GB G

N83-20417# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

PHOTOBIOLOGY TASK OF THE ADVANCED SOLAR ENERGY RESEARCH PROGRAM Progress Report, 1 Apr. - 30 Sep. 1980

M. SEIBERT, S LIEN, P WEAVER, J SCHULTZ, and P ROESSLER Mar. 1982 48 p refs
(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE82-012310, SERI/PR-233-1395) Avail NTIS HC A03/MF A01

Three areas of photobiological research are currently under investigations: *in vivo* microbial hydrogen photoproduction, algal hydrocarbon production, and *in vitro* energy conversion. The first involves environmental and mutational analyses of metabolism and electron transport in photosynthetic bacteria, leading to enhanced hydrogen photoproduction by these organisms Also included in the first area is the characterization of algal hydrogenases and both the biochemical and genetic manipulation of algal electron transport to enhance *in vivo* hydrogen photoproduction The second seeks to identify algal strains that produce large amounts of oil or hydrocarbons and to understand the mechanisms and biochemistry involved The third is aimed at electrically coupling photoactive biological complexes to metal and semiconductor electrodes DOE

N83-20426# Mid-American Solar Energy Complex, Minneapolis, Minn Div of State Energy

WISCONSIN COLLECTOR-EFFICIENCY STUDY, PHASE TWO

B L ALBRIGHT 15 Jan 1982 24 p Prepared in cooperation with the Wisconsin Dept of Administration, Madison
(Contract DE-AC02-79CS-30150)
(DE82-013425, MASEC-SCR-82-001) Avail NTIS HC A02/MF A01

The collector efficiency study developed a solar collector rating methodology specific to Wisconsin conditions. Existing rating programs were researched and a collector methodology was developed A computer program was written to calculate the collector ratings and 25 collector models were rated The accuracy of the proposed rating methodology was evaluated for 16 collectors placed in 11 domestic hot water systems One liquid space heating analysis with storage and one air space heating analysis without storage were completed A solar assisted heat pump in which the solar collectors function as evaporators was also analyzed DOE

N83-20428# Brookhaven National Lab., Upton, N Y Solar Technology Group

LOW-COST, HIGH-PERFORMANCE SOLAR FLAT-PLATE COLLECTORS FOR APPLICATIONS IN NORTHERN LATITUDES

W G WILHELM 1981 8 p refs Presented at the 2nd Intern Conf on Energy for Rural and Island Communities, Glasgow, 1-4 Sep 1981
(Contract DE-AC02-76CH-00016)
(DE82-010626, BNL-30633, CONF-8109112-1) Avail NTIS HC A02/MF A01

Solar flat plate collector designs were developed which incorporate high performance polymer film and laminate technology that have a projected manufacturing cost approaching \$15/sq m Their potential thermal performance is consistent with the best commercial solar flat plate collectors available today DOE

N83-20436# Economic Research Service, Washington, D C Natural Resource Economics Div

PROGRESS OF SOLAR TECHNOLOGY AND POTENTIAL FARM USES

W G HEID, JR and W K TROTTER Sep 1982 121 p refs
(PB83-100065, AER-489) Avail NTIS HC A06/MF A01 CSCL 02B

The efficient use of solar energy on farms for space heating and cooling of livestock buildings, drying crops, and heating farm homes is discussed Low cost, homemade solar collectors, having multiple uses and a payback of less than 5 years, are the most popular systems In contrast, most commercially produced systems

02 SOLAR ENERGY

are still too expensive for agricultural uses, partly because they fail to qualify for tax credits as large as those allowed for residential uses. The solar industry has shown little interest in marketing the low cost technologies specifically developed for agriculture

Author (GRA)

N83-20441# Insights West, Inc., Los Angeles, Calif.
SOLAR-AUGMENTED APPLICATIONS IN INDUSTRY. PHASE 2: CONCEPTUAL DESIGNS, VOLUME 1 Final Report, Jun. 1980 - Dec. 1981

R. A. CASPER, D. W. KEARNEY, and J. H. WILLIAMS Jul. 1982 192 p Sponsored by Gas Research Inst.
(PB83-102301; GRI-80-0016) Avail: NTIS HC A09/MF A01 CSCL 10A

The objective of this project was to carry out conceptual designs of solar/gas energy systems for industrial process heat applications at the plants of selected industrial participants. Agreements were secured from eight industrial firms to participate in a solar/gas IPh conceptual design program. The conceptual designs were completed as planned, examining the solar/gas interface, process energy needs, the solar system requirements, and the economics of the installation. Five of the designs were recommended for consideration as field test sites. Subsequent field development activities are deferred pending a detailed assessment of the R&D required for cost-competitive solar/gas systems. GRA

N83-20768# Swedlow, Inc., Garden Grove, Calif.
DESIGN AND DEVELOPMENT OF MONOLITHIC ACRYLIC FRESNEL LENSES FOR USE IN POINT-FOCUS PV SYSTEMS

C. M. CHILDERS Dec. 1981 47 p refs
(Contract DE-AC04-76DP-00789)
(DE82-007554; SAND-81-7040) Avail: NTIS HC A03/MF A01

The design, tooling, manufacturing, and testing of a new cast acrylic Fresnel lens array which is used as a solar concentrator are described. The array consists of twenty-five (25) single lens elements which are 6.7 inches square; the overall array size is 34.5 inches by 34.5 inches which includes a mounting border. These lens arrays will be used to focus sunlight at a net concentration ratio of 96/1 on passively cooled silicon cells in state-of-the-art concentrator modules. Tests at Swedlow and Sandia indicated that lenses developed for this program exceeded the lens transmission efficiency goal of 79%. DOE

N83-20802# Brown Univ., Providence, R. I. Materials Research Lab.

INTERDISCIPLINARY RESEARCH COVERING PLASTICITY OF SOLIDS, FRACTURE OF SOLIDS, INORGANIC GLASSES, AND LOWER DIMENSIONALITY MATERIALS AND STRUCTURES Annual Technical Report, 1 Jul. 1980 - 30 Jun. 1981

R. J. ASARO, D. H. AVERY, P. J. BRAY, K. B. BROBERG, and R. J. CLIFTON 30 Jun. 1981 74 p refs
(Contract NSF DMR-79-23257)
(AD-A113883) Avail: NTIS HC A04/MF A01 CSCL 20L

Research conducted by the Brown University Materials Research Laboratory is reported. Research activities included: plasticity of solids, fracture of solids, inorganic glasses, lower dimensionality materials and structures, solid surfaces, properties of materials at low temperatures, and materials for solar energy conversion. L F M

N83-21154# Sandia Labs, Albuquerque, N. Mex
EFFECTS OF GAPS IN ADHESIVES THAT BOND ELASTICALLY DEFORMED PANELS TO PARABOLIC, CYLINDRICAL SUBSTRUCTURES

R. K. WILSON and R. C. REUTER, JR. Mar. 1982 35 p refs
(Contract DE-AC04-76DP-00789)
(DE82-014720; SAND-82-0291) Avail: NTIS HC A03/MF A01

In previous studies of the mechanical behavior of line focusing solar collectors, the reflective surface panel was modeled as a thin, initially flat, elastic plate that underwent large displacements to attain the shape of a prescribed parabolic cylinder. Among the myriad possible collector designs, some possess longitudinally oriented, hollow ribs or corrugations in the substructure which

interrupt the transverse continuity of the bond line between the deformed panel and the substructure. Thus, finite gaps in the adhesive are present which create regions where the panel surface becomes intermittently supported. The presence of these gaps perturbs the otherwise smooth distribution of adhesive contact stresses and it is the analytical modeling of this behavior that is the subject of the present report. In particular, attention is devoted to gaps which overlap with the edge effect zone, a region near the rim or vertex of the deformed panel where, in the absence of uniform edge loads necessary to maintain a true parabolic shape, high stresses and associated deformations occur. DOE

N83-21200# BDM Corp., Albuquerque, N. Mex.
DESIGN AND FABRICATION OF A PROTOTYPE SYSTEM FOR PHOTOVOLTAIC RESIDENCES IN THE SOUTHWEST Final Report

Aug. 1982 159 p
(Contract DE-AC02-76ET-20279)
(DE83-003935; DOE/ET-20279/225) Avail: NTIS HC A08/MF A01

The design, fabrication, and maintenance of a prototype residential photovoltaic (PV) power system installed and operated at the Southwest Residential Station in Las Cruces, New Mexico is reported. The program identifies and resolves engineering problems that result from the widespread use of residential PV systems. The tasks accomplished are documented and overall system design and performance are evaluated. DOE

N83-21202# Townsend (Anne) Associates, Inc., Arlington, Va
PASSIVE-SOLAR COMMERCIAL BUILDINGS PROGRAM, 1980 - 1982 Summary Report

L. GIALANELLA Feb. 1982 24 p refs
(Contract DE-AM03-76SF-00700)
(DE82-012472; DOE/SF-00700/T4) Avail: NTIS HC A02/MF A01

Support of research and development, promotion of utilization, and sponsoring of education and training were summarized. The program structure, approach, systematic overlapping of projects, and accomplishments are detailed. Impacts on the building and design industry are discussed. DOE

N83-21413# Sandia Labs, Albuquerque, N. Mex
DEFORMATION OF A THIN, ELASTIC PLATE TO A DEEP PARABOLIC CYLINDER

R. C. REUTER, JR. and R. K. WILSON Feb. 1982 21 p refs
(Contract DE-AC04-76DP-00789)
(DE82-012056; SAND-82-0099) Avail: NTIS HC A02/MF A01

Equations governing the elastic deformation of thin plates through large displacements to deep parabolic cylinders are presented and solved. The solution consists of expressions for a spatially distributed surface pressure and uniform rim loads which, when applied to the plate, produce the specified, deep parabolic cylindrical shape. These forming loads are written in dimensionless form for parabolic cylinders of arbitrary focal length and arbitrary rim to rim aperture. Numerical results are presented and limiting values are discussed. The solution and results find immediate application to mechanical forming and adhesive retention of parabolic solar collector components. DOE

N83-21510*# Jet Propulsion Lab., California Inst of Tech., Pasadena
RESULTS OF THE 1982 NASA/JPL BALLOON FLIGHT SOLAR CELL CALIBRATION PROGRAM

R. G. DOWNING and R. S. WEISS 1 Mar. 1983 16 p refs
(NASA-CR-170123; NAS 1 26 170123; JPL-PUB-83-1) Avail: NTIS HC A02/MF A01 CSCL 10A

The 1982 solar cell calibration balloon flight was successfully completed on July 21, meeting all objectives of the program. Twenty-eight modules were carried to an altitude of 36.0 kilometers. The calibrated cells can now be used as reference standards in simulator testing of cells and arrays. Author

N83-21512*# Spectrolab, Inc., Sylmar, Calif. Advanced Programs

LARGE AREA, LOW COST SOLAR CELL DEVELOPMENT AND PRODUCTION READINESS Final Report

D MICHAELS Jan 1982 60 p refs
(Contract NAS9-16126)

(NASA-CR-170037, NAS 1 26 170037) Avail. NTIS HC A04/MF A01 CSCL 10A

A process sequence for a large area (or = 25 sq cm) silicon solar cell was investigated. Generic cell choice was guided by the expected electron fluence, by the packing factors of various cell envelope designs onto each panel to provide needed voltage as well as current, by the weight constraints on the system, and by the cost goals of the contract. Author

N83-21513# AEG-Telefunken, Wedel (West Germany). Anlagentechnik AG

TECHNOLOGY OF ELEVATED VOLTAGE SOLAR ARRAYS: KEY ITEMS TEST AND EVALUATION. PART 2: SIMULATED LEO-PLASMA TESTS Final Report

H BEBERMEIER, G. EGGERS, R NUERNBERGER, W. GOELZ, and G STASEK (Physik-Tech Studien GmbH, Freiburg, West Ger) Paris ESA Mar 1982 114 p refs

(Contract ESTEC-3662/78/NL-HP, ESA-4623/81/NL-PP(SC)) (ESA-CR(P)-1646) Avail. NTIS HC A06/MF A01

The electrical layout of a 250 kW solar array was analyzed in TEVSA-KITE I and potential problem areas were identified. In the present report (TEVSA-KITE II) research and development activities are described which have been made necessary by the desire to understand the phenomena observed in the initial tests and to make a more complete assessment of the in-orbit effects of 200 - 1000 volt solar arrays. System and component requirements of the power-conditioning system were compared with current practice in order to identify areas requiring development effort. It was found that for voltages up to 200/300 V, components and systems are available but are not yet space qualified. The high-voltage tests of solar-array components were continued. A critical threshold of 500 - 600 V was identified for vacuum orbit conditions. Outgassing after launch may be a potential reason for failure. The plasma tests at Freiburg showed that there was a very narrow range in which ohmic discharge occurs. Outside this range, a dramatic increase in leakage current is expected. The critical voltage threshold was identified at ca 250 V. The study shows that current solar-array technology is adequate for low Earth orbit environment up to a voltage of about 250 V. Plasma discharge will then be initiated. At voltages above 500/600 V, partial discharge through the substrate will reduce the lifetime of the solar array.

Author (ESA)

N83-21514# European Space Agency, Paris (France)
EVALUATION OF VARIOUS SOLAR-CELL-TO-INTERCONNECTOR WELDS BY MEANS OF SCANNING LASER ACOUSTIC MICROSCOPY AND METALLOGRAPHY

B D DUNN (ESTEC, Noordwijk, Neth) and W R BURKE, ed Aug. 1982 44 p refs
(ESA-STM-225, ISSN-0397-4075) Avail. NTIS HC A03/MF A01

The quality of electrical resistance welds uniting spacecraft solar array components, such as solar cells, interconnectors, shunt diodes and bus bars cannot be assessed by visual inspection. A variety of welded samples, some joined in typical spacecraft configurations and following environmental testing, were examined by nondestructive testing and metallography. The size of the welds was determined and their position located by scanning laser acoustic microscopy. The high accuracy of acoustic micrographs is confirmed by mechanical tests and metallography. A procedure for microsectioning is recommended; it is essential to remove the smeared silver layer on as polished microsections, to reveal the true weld. Of the various interconnector materials it appears that the silver coated molybdenum type provides the most reliable weld. E A K

N83-21515# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hardhausen (West Germany) Abteilung Energie und Antriebe

THERMODYNAMIC MODEL FOR A CENTRAL RECEIVER OF A SOLAR PLANT WITH PARTIAL SHADING OF THE HELIOSTAT FIELD

J. REINKENHOF Jul 1982 121 p refs In GERMAN, ENGLISH summary Report will also be announced as translation (ESA-TT-807)

(DFVLR-FB-82-27, ESA-TT-807) Avail. NTIS HC A06/MF A01

The time-dependent loss mechanisms of a heliostat field and a stochastic model for the simulation of partial shading of the heliostat field are discussed. The coupling of the heliostat field with the receiver is reduced to the problem of an aperture covered with directed energy sources and sinks. For the intensity distribution over the aperture a two-dimensional normal distribution was selected. The density of the energy flow can be calculated for any point within the receiver. The local heat flux toward the walls of a receiver with arbitrary geometry is estimated. Especially the case of isothermal walls with re-emitted radiation escaping through the aperture is treated. A computer code CEREMO and numerical results are presented. M G

N83-21517# Boeing Computer Services, Inc., Seattle, Wash
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE REPORT. VOLUME 5: FOR CDC LIGHT MANUFACTURING BUILDING, SAN BERNARDINO, CALIFORNIA, FOR JULY 1982

Nov. 1982 24 p

(Contract DE-AC04-76DP-00789)

(DE83-003801, SAND-81-7089/5) Avail. NTIS HC A02/MF A01

Presented are the data accumulated during July at the intermediate photovoltaic project at the CDC Light Manufacturing Bldg., San Bernardino, California. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided. DOE

N83-21518# Oak Ridge National Lab., Tenn. Energy Div
EVALUATION OF MISSISSIPPI COUNTY COMMUNITY COLLEGE AND NORTHWEST MISSISSIPPI JUNIOR COLLEGE SOLAR POWER SYSTEMS

S I KAPLAN Dec 1982 40 p refs

(Contract W-7405-ENG-26)

(DE83-004239, ORNL/TM-8396) Avail. NTIS HC A03/MF A01

Mississippi County Community College (MCCC) and Northwest Mississippi Junior College (NMJC) are the respective sites for two solar power projects. The MCCC Project is undergoing post-startup testing and adjustment; the NMJC equipment is partially installed, and work is currently suspended. The design, construction, test history through October 1981, and recommendations for system improvement at MCCC are discussed, the probable maximum output from the system is estimated. The NMJC project history and status are reviewed and its viability as an operating project is evaluated. DOE

N83-21521# Honeywell, Inc., Roseville, Minn. Technology Strategy Center

SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: HONEYWELL OTS 41, SHENANDOAH (NEWMAN), GEORGIA Final Report

A K. MATHUR and S PEDERSON Aug 1982 87 p refs

(Contract DE-AC03-81CS-30574)

(DE82-021004, DOE/CS-30574/T1) Avail. NTIS HC A05/MF A01

The operation and technical performance of the Solar Operational Test Site (OTS 41) located at Shenandoah, Georgia, are described, based on the analysis of the data collected between January and August 1981. The following topics are discussed: system description, performance assessment, operating energy, energy savings, system maintenance, and conclusions. The solar energy system at OTS 41 is a hydronic heating and cooling system consisting of 702 square feet of liquid-cooled flat-plate collectors;

02 SOLAR ENERGY

a 1000-gallon thermal storage tank; a 3-ton capacity organic Rankine-cycle-engine-assisted air conditioner; a water-to-air heat exchanger for solar space heating; a finned-tube coil immersed in the storage tank to preheat water for a gas-fired hot water heater; and associated piping, pumps, valves, and controls. The solar system has six basic modes of operation and several combination modes. The system operation is controlled automatically by a Honeywell-designed microprocessor-based control system, which also provides diagnostics. DOE

N83-21522# Bechtel Corp., San Francisco, Calif.
STUDY OF INSTALLED AND LIFE-CYCLE COSTS FOR BATTERIES IN PHOTOVOLTAIC POWER SYSTEMS Final Report

Oct. 1982 452 p refs
(Contract DE-AC04-76DP-00789)

(DE83-003849, SAND-82-7059) Avail: NTIS HC A20/MF A01

The overall objective was to estimate the installed and life-cycle costs of 9 battery technologies in a range of photovoltaic application types and sizes. For each battery type is given is a description of the battery technology, the battery factory price analysis, and the installed and life-cycle cost estimates for the battery in each of the applications evaluated. Battery types include: conventional lead-acid; sealed lead-acid; redox; zinc-bromine batteries of two types, zinc chloride; iron redox; lithium-metal sulfide; and sodium-sulfur. Applications include: shopping center; high school; multiple residence; hotel-motel, remote residence, and single residence DOE

N83-21530# Honeywell, Inc., Roseville, Minn Technology Strategy Center

SOLAR-ENERGY-SYSTEM PERFORMANCE EVALUATION: HONEYWELL OTS 44, OCMULGEE, GEORGIA Final Report

A. K. MATHUR and S. PEDERSON Aug. 1982 73 p refs
(Contract NAS8-32093; DE-AC03-81CS-30574)

(NASA-CR-170031, NAS 1 26-170031, DE83-000086, DOE/CS-30574/T2) Avail: NTIS HC A04/MF A01

The operation and technical performance of the solar operational test site (OTS 44) are described, based on data collected between April, 1981 and August, 1981. The following topics are discussed: system description, performance assessment, operating energy, energy savings, system maintenance, and conclusions. The solar energy system at OTS 44 is a hydronic heating and cooling system consisting of 5040 square feet of liquid cooled flat plate collectors, a 4000 gallon thermal storage tank, one 25 ton capacity organic Rankine cycle engine assisted water chillers; a forced draft cooling tower; and associated piping, pumps, valves, controls and heat rejection equipment. The solar system has eight basic modes of operation and several combination modes for providing space conditioning and hot water to the building. Data monitored during the 4 months of the operational test period found that the solar system collected 285 MMBtu of thermal energy of the total incident solar energy of 1040 MMBtu and provided 210 MMBtu for cooling and 10 MMBtu for heating and hot water. The net electrical energy saving due to the solar system was approximately 2600 kWh(e), and fossil energy saving was about 20 million Btu (MMBtu) DOE

N83-21537# Sandia Labs., Albuquerque, N. Mex Photovoltaic Concentrator Technology Div.

SHADING ANALYSIS OF A PHOTOVOLTAIC-CELL STRING ILLUMINATED BY A PARABOLIC-TROUGH CONCENTRATOR

M. W. EDENBURN and J. R. BURNS (Texas Technological Univ., Lubbock) Sep. 1982 27 p refs
(Contract DE-AC04-76DP-00789)

(DE83-002646; SAND-81-2270) Avail: NTIS HC A03/MF A01

The analysis considers a linear string of cells with diode bypassing illuminated by a horizontal north-south axis, parabolic trough, sunlight concentrator. Shadows are cast on the cell string by the end of the concentrator and by transverse gaps in its reflective surface. There are three parts to the model used in the analysis: (1) a model that determines the illumination for each cell; (2) a model that calculates the I-V curve for each cell; and

(3) a string model that determines if diode strings are bypassed and finds the whole string's maximum power. The three parts of the model were used in an annual simulation to determine the performance of a string for a variety of diode arrangements, for cell removal from the south end, and for cell addition to the north end of the receiver. The analyses show that string performance is improved by removing cells from the south end and adding cells to the north end of the receiver, and by using a smaller number of cells per diode at the ends of the receiver DOE

N83-21539# Westinghouse Research and Development Center, Pittsburgh, Pa

DEVELOPMENT OF COPPER SULFIDE/CADMIUM SULFIDE THIN-FILM SOLAR CELLS Technical Progress Report, 1 Jan. - 31 Mar. 1982

J. R. SZEDON 26 Aug 1982 24 p refs

(Contract DE-AC02-77CH-00178)

(DE83-001421, SER/PR-8143-1-T10, TPR-11) Avail: NTIS HC A02/MF A01

The improvement of the stability of Cu₂S/CdS thin film solar cells with conversion efficiency values of 9% or greater were characterized. The identification of mechanisms which degrade cell performance, improvement of the stability of cells by encapsulation, and to improve the intrinsic stability of the cells by modifying the cell structure during or after fabrication is studied. No rapid component of short circuit current loss due to aging in moist oxygen was found. For the first 54 hours of aging results can be fitted using a single time constant with a value of about 30 hours. Information was obtained on the rate of change of the effective density of donors in the CdS space charge region, which modulates the tunnelling opposing current that controls open circuit voltage behavior in these cells. An increase in the density of donors of about 70% during 400 hours of aging is observed. The increase could be fit to an exponential function with a time constant of about 35 hours. DOE

N83-21541# Boeing Computer Services, Inc., Seattle, Wash.

INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE REPORT. VOLUME 2: G. N. WILCOX MEMORIAL HOSPITAL, KAUAI, HAWAII

Oct 1982 51 p 2 Vol

(Contract DE-AC04-76DP-00789)

(DE83-002139; SAND-81-7080-2) Avail: NTIS HC A04/MF A01

Energy generation and environmental (weather) data accumulated during April and May 1982 were presented. Explanations of irregularities not attributed to weather were provided B.G.

N83-21542# Advanced Energy and Technology Associates, Dover, N.H.

BENEFITS ANALYSIS FOR THE PRODUCTION OF FUELS AND CHEMICALS USING SOLAR THERMAL ENERGY Final Report

May 1982 155 p refs

(Contract DE-AC03-81SF-11526)

(DE83-001023; DOE/SF-11526/T1) Avail: NTIS HC A08/MF A01

A decision analysis technique geared to the analysis of Sun fuels options was developed. Conventional scoring methods were combined with multi-attribute utility analysis in a new approach called the Multi-Attribute Preference Scoring (MAPS) system. MAPS calls for the designation of major categories of attributes which describe critical elements of concern for the processes being examined. The six major categories include: Process Demonstration; Full-Scale Process; Feedstock; End-Product Market; National/Social Considerations; and Economics. MAPS calls for each attribute to be weighted on a simple scale for all of the candidate processes. Next, a weight is assigned to each attribute, thus creating a multiplier to be used with each individual value to derive a comparative weighting. Last, each of the categories of attributes themselves are weighted, thus creating another multiplier, for use in developing an overall score. With sufficient information and industry input, each process can be

ultimately compared using a single figure of merit. Three synthesis gas processes, two hydrogen and one ammonia were fully assessed, and fourteen processes were partially assessed. DOE

N83-21546# Tennessee Valley Authority, Chattanooga. Technical Support Section

ENERGY USE TEST FACILITY: CAC-DOE SOLAR AIR HEATER TEST REPORT

Nov 1981 59 p refs

(DE83-900162, TVA/OP-ECR-82-30) Avail: NTIS HC A04/MF A01

The solar air heater testing demonstrated an attractive application for residential space heating, especially appealing to the do-it-yourself market. Simple improvements in construction, such as caulking of the glazing, could increase collector performance at little cost. The operating cost of the fan was insignificant, being less than \$0.05/week. Tested in its as-shipped configuration at 96.1 cfm (3 cfm/ft²), the useful energy delivered averaged 20,000 Btu/day for six days in December. The electrical consumption of the fan was approximately 1 kWh. Doubling the flowrate did not increase collector performance appreciably. A TRNSYS computer simulation model for this solar air heater design was validated by comparing the measured test data on January 4, 1981 with calculated values. TRNSYS predicted that measured collector outlet temperatures within $\pm 1.20^\circ\text{F}$ and the energy delivered within $\pm 3\%$. The excellent agreement was obtained by adjusting the collector loss coefficient to an unrealistically low value, therefore, a parametric study is recommended to determine the model sensitivity to varying different parameters. A first-order collector efficiency curve was derived from the TRNSYS simulations which compared well with the curve defined by the clear-day measured data. DOE

N83-21547# Boeing Engineering and Construction Co., Seattle, Wash.

PHOTOVOLTAIC CONCENTRATOR WITH PLASTIC-FILM REFLECTOR Final Report

Jun 1982 84 p refs

(Contract DE-AC04-76DP-00789)

(DE83-001715, SAND-82-7102) Avail: NTIS HC A05/MF A01

A 4 m diameter reflective film, parabolic dish concentrator proposed for use with a photovoltaic array has been designed, fabricated, and tested. The concentrator is made from aluminized film gores (wedge shaped pieces) that are taped together along their edges to form a dish. The shape of the dish is maintained by a pressure difference between the front and back. The deep dish was designed to illuminate a cylindrical receiver populated by solar cells with a geometric concentration ratio of 145. Three full scale dishes were made in sequence, each using improvements suggested by the previous design. They were tested with a laser to determine surface errors and flux uniformity on the target. DOE

N83-21551# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif

A 10-MWE SOLAR-THERMAL CENTRAL-RECEIVER PILOT PLANT: SOLAR FACILITIES DESIGN INTEGRATION. PLANT OPERATING/TRAINING MANUAL (RADL-ITEM 2-36)

Jul 1982 301 p

(Contract DE-AC03-79SF-10499)

(DE83-001670, DOE/SF-10499/83-REV, SAN-049983-REV, MDC-G-9707-REV) Avail: NTIS HC A14/MF A01

Plant and system level operating instructions are provided for the Barstow Solar Pilot Plant. Individual status instructions are given that identify plant conditions, process controller responsibilities, process conditions and control accuracies, operating envelopes, and operator cautions appropriate to the operating condition. Transition operating instructions identify the sequence of activities to be carried out to accomplish the indicated transition. Most transitions involve the startup or shutdown of an individual flowpath. Background information is provided on collector field operations, and the heliostat groupings and specific commands used in support receiver startup are defined. Author

N83-21555# San Diego Unified School District, Calif
INTEGRATED SOLAR HEATING, COOLING, AND HOT-WATER SYSTEM FOR UNIVERSITY CITY HIGH SCHOOL, SAN DIEGO, CALIFORNIA Final Report

1982 419 p

(Contract DE-FC03-77CS-31499; EG-77-A-03-1499)

(DE82-020993, DOE/CS-31499/T2) Avail: NTIS HC A18/MF A01

This active hydronic system for solar heating, absorption cooling, and water heating uses 17,532 square feet of concentrating collectors. The storage capacity is 88,800 gallons. The system schematics and operation and maintenance instructions are included. DOE

N83-21556# Sandia Labs., Albuquerque, N. Mex
Electromechanical Component Test Equipment

A MICROPROCESSOR-CONTROLLED PHOTOVOLTAIC-ARRAY LOADING UNIT

D. F. RUSSELL. Aug. 1982 60 p

(Contract DE-AC04-76DP-00789)

(DE83-000797, SAND-82-1744) Avail: NTIS HC A04/MF A01

A microprocessor controlled test system in operation at the Photovoltaics Advanced Systems Test Facility is described. The test system is designed to measure the total energy output of photovoltaic arrays. The theory, installation, operation, and calibration of the test system are described. DOE

N83-21557# Wolf (Ludwig, Jr.), Crystal Lake, Ill
THE DESIGN, EFFECTIVENESS AND CONSTRUCTION OF PASSIVE-THERMAL-CONTROL ROOFING SHINGLES Technical Final Report

L. WOLF, JR. Sep 1982 61 p

(Contract DE-FG02-81R5-10296)

(DE83-001465; DOE/R5-10296/T1) Avail: NTIS HC A04/MF A01

The concept of a passive thermal control roofing shingle, which is a shingle that reflects the summer sun and absorbs the winter sun, is discussed. It is indicated that it is possible to design shingles for particular latitudes and styles of roof which absorb nearly all of the winter solar energy and reflect nearly all of the summer solar energy. Calculations of the energy savings and cost effectiveness of the passive thermal control roofing shingle indicate that it is most cost effective on all south facing pitched roofs regardless of heating fuel type, and on flat or east or west facing roofs that are heated with costly fuels such as electricity or heating oil. The shingle is most effective on poorly insulated structures. The feasibility of using the passive thermal control roofing shingle in conjunction with a heat pump to pump heat absorbed by the shingle into a well insulated structure is demonstrated. Construction of a variety of models of the passive thermal control roofing shingle illustrate numerous alternate methods of manufacture. A profile extruded, plastic, glazed shingle appears to be the most promising approach. Use of a glazed shingle can increase the effectiveness of the passive thermal control roofing shingle by reducing convective heat losses. DOE

N83-21558# JBF Scientific Corp., Wilmington, Mass
ASSESSMENT OF DISTRIBUTED PHOTOVOLTAIC ELECTRIC-POWER SYSTEMS Summary Report

R. W. NEAL, P. F. DEDUCK, and R. N. MARSHALL. Oct 1982 53 p

(Contract EPRI PROJ 1192-1)

(DE83-900531, EPRI-AP-2687-SY) Avail: NTIS HC A04/MF A01

The development of a methodology to assess the potential impacts of distributed photovoltaic (PV) systems on electric utility systems, including subtransmission and distribution networks, and to apply that methodology to several illustrative examples was developed. The investigations focused upon five specific utilities. Impacts upon utility system operations and generation mix were assessed using accepted utility planning methods in combination with models that simulate PV system performance and life cycle economics. Impacts on the utility subtransmission and distribution

02 SOLAR ENERGY

systems were also investigated. The economic potential of distributed PV systems was investigated for ownership by the utility as well as by the individual utility customer. DOE

N83-21560# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
FLASH PHOTOELECTROCHEMICAL STUDIES OF TRANSIENT ELECTRODE PROCESSES IMPORTANT IN SOLAR-ENERGY CONVERSION Final Report
S. P. PERONE Oct. 1982 25 p
(Contract DE-AC02-77ER-04263)
(DE83-003134; DOE/ER-04263/5) Avail. NTIS HC A02/MF A01

Electroanalytical and spectroscopic measurement techniques were applied to the study of transient photolytic, photoemissive, and photoelectrolytic processes associated with UV-visible irradiation of an electrode/solution interface. Both semiconductor and metallic electrodes were employed. For the characterization of transient phenomena, the general methodology of flash photolysis was employed (including both xenon flash lamp and tunable pulsed dye laser sources). The perspective afforded by transient electroanalytical/spectroscopic measurements of photoinitiated electrode processes provided more definitive mechanistic insight to solar conversion phenomena in photogalvanic or photoelectrolysis processes. DOE

N83-21562# Advanced Technology, Inc., McLean, Va.
PHOTOVOLTAIC OFF-FARM AGRICULTURAL APPLICATIONS: VOLUME 2: TECHNICAL REPORT Final Report
W. F. ADOLFSOHN Feb. 1982 200 p refs
(Contract DE-AC04-76DP-00789)
(DE82-009320; SAND-81-7175-VOL-2) Avail. NTIS HC A09/MF A01

Five conceptual designs available for supplementing the energy required by off-farm agricultural applications are highlighted. Illustrations and parametric cost analyses are provided to assist energy managers in assessing the options and selecting designs for retrofit of existing systems or incorporation of new installations. DOE

N83-21563# Boeing Computer Services, Inc., Seattle, Wash.
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE. VOLUME 5: BEVERLY HIGH SCHOOL, BEVERLY MASSACHUSETTS, EXECUTIVE SUMMARY
Mar. 1982 8 p refs
(Contract DE-AC04-76DP-00789)
(DE82-014711; SAND-81-7102/5-VOL-5) Avail. NTIS HC A02/MF A01

Performance data are given for a grid-connected, 100 kW, flat panel photovoltaic power system at a Massachusetts high school for the month of February 1982. Data include daily and monthly electrical energy produced, daily and monthly plane-of-array incident solar energy, array efficiency, power conditioner efficiency, system efficiency, capacity factor, and monthly average insolation. Also included is the data acquisition mode and recording interval plot. DOE

N83-21564# Boeing Computer Services, Inc., Seattle, Wash.
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL EXECUTIVE SUMMARY. VOLUME 7: NEWMAN POWER STATION, EL PASO, TEXAS
Feb. 1982 11 p refs
(Contract DE-AC04-76DP-00789)
(DE82-014647; SAND-81-7100/7-VOL-7) Avail. NTIS HC A02/MF A01

Performance data are given for a 20 kW photovoltaic power system for a computer's uninterruptible power supply at a Texas utility for the month of January 1982. Data given include daily and monthly electrical energy produced, daily and monthly plane-of-array incident solar energy, array efficiency, capacity factor, and monthly average plane-of-array insolation. Also included is the data acquisition mode and recording interval plot and five

site event report summaries involving data acquisition and one event of array damage. DOE

N83-21566# Boeing Computer Services, Inc., Seattle, Wash.
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE EXECUTIVE SUMMARY. VOLUME 7: LOVINGTON SQUARE SHOPPING CENTER, LOVINGTON, NEW MEXICO
Feb. 1982 10 p refs
(Contract DE-AC04-76DP-00789)
(DE82-014649; SAND-81-7099/7-VOL-7) Avail. NTIS HC A02/MF A01

Performance data are given for a 100 kW grid-connected flat panel photovoltaic power supply at a New Mexico shopping center for the month of January 1982. Data include the daily and monthly electrical energy produced, daily and monthly solar energy incident on the array plane, average array efficiency, power conditioner efficiency, system efficiency, capacity factor, and monthly average plane-of-array insolation. Also included is the data acquisition mode and recording interval plot and three site event report summaries involving data collection. DOE

N83-21567# Sandia Labs., Albuquerque, N. Mex.
CENTRAL RECEIVER TEST FACILITY ASSEMBLY BUILDING
C. R. MAXWELL and J. T. HOLMES Jan. 1982 16 p refs
(Contract DE-AC04-76DP-00789)
(DE82-010853; SAND-81-1735) Avail. NTIS HC A02/MF A01

The passively solar heated Assembly Building located at the Central Receiver Test Facility and its performance during a one-year data acquisition period are described. The effect of the air changes per hour on the solar savings fraction as well as the performance of the south facing thermal storage wall when supplementally illuminated are detailed. DOE

N83-21568# Midwest Research Inst., Golden, Colo.
Solar Energy Research Inst.
STEAM GENERATION IN LINE-FOCUS SOLAR COLLECTORS: A COMPARATIVE ASSESSMENT OF THERMAL PERFORMANCE, OPERATING STABILITY AND COST ISSUES
L. M. MURPHY and E. K. MAY Apr. 1982 166 p refs
(Contract DE-AC02-77CH-00178; EG-77-C-4042)
(DE82-014531; SERI/TR-632-1311) Avail. NTIS HC A08/MF A01

The engineering and system benefits of using direct steam (in situ) generation in line-focus collectors are assessed. The major emphasis of the analysis is a detailed thermal performance comparison of in situ systems (which utilize unfired boilers). The analysis model developed for this study is discussed in detail. An analysis of potential flow stability problems is also provided along with a cursory cost analysis and an assessment of freeze protection, safety, and control issues. Results indicated a significant thermal performance advantage over the more conventional oil and flash systems and the flow stability does not appear to be a significant problem. In particular, at steam temperatures of 220 C (430 F) under the chosen set of assumptions, annual delivered energy predictions indicate that the in situ system can deliver 15% more energy than an oil system and 12% more energy than a flash system, with all of the systems using the same collector field. Further, the in situ system may result in a 10% capital cost reduction. DOE

N83-21569# Midwest Research Inst., Golden, Colo.
Solar Energy Research Inst.
ENERGY-CONSERVING AND PASSIVE-SOLAR CONSTRUCTION DETAILS
R. D. TAYLOR Apr. 1982 29 p
(Contract DE-AC02-77CH-00178)
(DE82-014467; SERI/SP-721-1135R) Avail. NTIS HC A03/MF A01

Many cost effective solutions to the major passive solar concept problems that can be applied to a whole range of residential and light commercial buildings are presented. Some passive solar components are presented that were site built but which lend

themselves to being manufactured and installed by building tradesmen. Twenty-four construction detail drawings are included.
DOE

N83-21570# Boeing Co., Seattle, Wash
SOLAR PROJECT DESCRIPTION FOR GILL HARROP BUILDERS SINGLE-FAMILY DETACHED RESIDENCE, BIG FLATS, NEW YORK
23 Apr 1982 48 p
(Contract DE-AB01-76CS-31020)
(DE82-014984; SOLAR/1096-82/50) Avail. NTIS HC A03/MF A01

A house with approximately 1360 square feet of conditioned space heated by a direct gain system with manually operated insulated curtains is discussed. Solar heating is augmented by electric resistance heating, and a wood burning stove may be installed. Sunlight is admitted through both south facing windows and through clerestory collector panels and is absorbed and stored as heat in a concrete floor and wall. Heat is then distributed by natural convection and radiation. Temperature regulation is assisted by Earth beams. Three modes of operation are described: collector-to-storage, storage-to-space heating, and passive space cooling, which is accomplished by shading, movable insulation, and ventilation. The instrumentation for the National Solar Data Network is described. The solar energy portion of the construction costs is estimated.
DOE

N83-21579# Arinc Research Corp., Annapolis, Md
GUIDE FOR THE ASSESSMENT OF THE AVAILABILITY OF GASIFICATION-COMBINED-CYCLE POWER PLANTS Final Report
M. NEELY Jan 1982 79 p refs
(DE82-901905, EPRI-AP-2202) Avail. NTIS HC A05/MF A01

A guide that can be used for predicting the reliability and availability of coal gasification-combined-cycle (GCC) electric power generation units, as well as other electric power generation unit types is given. A prediction of plant effectiveness, a measure that can be directly related to availability, equivalent availability, forced-outage rate, and other performance measures is given. A seven-step availability assessment methodology that uses the concepts of unit states and state capabilities (the power output capability associated with each state) to produce predictions of a unit's effectiveness, availability, equivalent availability, critical components, and other measures of interest is given. As an illustration, the method is used to prepare an assessment of an 1150-megawatt baseload GCC plant that employs seven gas turbines, one steam turbine, and six oxygen-blown (Texaco) gasifiers. A complete data base of failure rates and mean downtimes for the GCC plant components and a documented computer program used for this analysis are also included.
DOE

N83-21582# Sandia Labs., Livermore, Calif
TESTING AND EVALUATION OF SECOND-GENERATION HELIOSTAT MIRROR MODULES
V. P. BUROLLA and W. R. DELAMETER Jan 1982 140 p refs
(Contract DE-AC04-76DP-00789)
(DE82-007934, SAND-81-8263) Avail. NTIS HC A07/MF A01

The testing and evaluation of the second generation heliostat mirror modules are reported. It was found that all of the previous design problems of mirror modules, such as silver corrosion, thermal defocus, and high glass stress, were eliminated by one or more of these designs. The single most important conclusion to be drawn from this program is that laminated glass mirror module designs are the most technically conservative, it is recommended that this concept be used for near term applications.
DOE

N83-21583# Chicago Univ., Ill. Enrico Fermi Inst.
ENGINEERING DEVELOPMENT STUDIES FOR INTEGRATED EVACUATED CPC ARRAYS Final Report, 19 Jan. 1981 - 18 Jan. 1982

R. WINSTON 23 Apr. 1982 50 p refs
(Contract DE-AC04-81AL-16223)
(DE82-013941; DOE/AL-16223/2) Avail. NTIS HC A03/MF A01

An evacuated tube concentrator which achieves respectable high temperature performance (100 C to 300 C) was developed. The design concept utilizes nonimaging CPC type concentration integrated into each tube by shaping the outer glass vacuum envelope. The detailed design, prototype fabrication and preliminary test measurements are reviewed. In addition the results of this first study specifically devoted to engineering development questions related to practical applications of this collector concept are summarized. Questions having to do with the deployment of medium to large area arrays, optimizations of the manifolding of individual tube panels, selected near term applications (with an emphasis on residential cooling based on Rankine driven chillers) and long term performance projections are addressed.
DOE

N83-21584# Acurex Corp., Mountain View, Calif
ADVANCED PHOTOVOLTAIC-TROUGH DEVELOPMENT
R. SPENCER, K. YASUDA, and B. MERSON Apr. 1982 204 p refs

(Contract DE-AC04-76DP-00789)
(DE82-015646; SAND-82-7117) Avail. NTIS HC A10/MF A01

The scope of the work on photovoltaic troughs includes analytical studies, hardware development, and component testing. Various aspects of the system have been optimized and improvements have been realized, particularly in the receiver and reflecting surface designs. An empirical system performance model has been developed that closely agrees with measured system performance. This in-depth study of single-axis reflecting linear focus photovoltaic concentrators will be very beneficial in the development of improved models for similar systems as well as other photovoltaic concentrator designs.
DOE

N83-21585# Sandia Labs., Albuquerque, N. Mex.
STRESS ANALYSIS OF SPHERICAL MIRROR PANELS
V. J. PARKS (NRL) and R. J. SANFORD (NRL) Apr. 1982 44 p refs

(Contract DE-AC04-76DP-00789)
(DE82-015656; SAND-82-7116) Avail. NTIS HC A03/MF A01

An experimental analysis is reported of the stresses that occur in elastically deformed, spherically curved glass mirrors for solar energy applications. Bending and membrane stresses generated in forming the glass and the effects of springback are analyzed. In addition, thermal stresses caused by focusing the Sun's rays on a small region of the mirrors are analyzed. Methods used in the analysis included the use of grids, photoelasticity, and strain gages. Results of the analysis are compared with a theoretical analysis performed by Shelltech Associates in a parallel effort.
DOE

N83-21603# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho Energy Measurements Group
PERFORMANCE TESTING OF THE ACUREX SOLAR COLLECTOR MODEL 3001-03

V. E. DUDLEY and R. M. WORKHOVEN (Sandia National Labs., Albuquerque, N. Mex.) Mar. 1982 122 p refs
(Contract DE-AC04-76DP-00789)

(DE82-013389, SAND-80-0872) Avail. NTIS HC A06/MF A01

Results are summarized of tests conducted at the Collector Module Test Facility on an Acurex Model 3001-03 Parabolic Trough Concentrating Solar Collector. Test temperature range was 100 C to 300 C. Tests were conducted with the collector axis oriented east-west and again with the collector axis oriented north-south. Three collectors were tested: one using polished aluminum mirrors, one using glass mirrors, and another using an aluminized acrylic film mirror.
DOE

02 SOLAR ENERGY

N83-21604# Massachusetts Inst of Tech, Cambridge.
**PERFORMANCE CHARACTERISTICS AND DESIGN CRITERIA
FOR THE THERMIC DIODE, A PASSIVE THERMOSYPHON
SOLAR HEATING SYSTEM Final Report**

B. S. BUCKLEY 1982 193 p refs
(Contract DE-AS02-77CS-34383)
(DE82-012455, DOE/CS-34383/A002) Avail NTIS (US Sales
Only) HC A09/MF A01, DOE Depository Libraries

A mathematical model developed into a computer simulation of the thermic diode is described. The computer model is divided into two principal sections that describe external and internal phenomena respectively. The timekeeping, data handling, calculation of solar angles of incidence on both horizontal and tilted surfaces, glazing effects, and simulation of the heating load are described. The modeling of the thermic diode includes heat flow calculations, and the derivation and solution of the partial differential equations in temperature. The validation of the model and comparison with active systems are discussed. The f chart method used to determine the most economical number of thermic diodes to use in a building is described. Monthly and yearly results of computer simulations for periods up to a year are summarized. Simulations were carried out for different cities, and also varying design and system installation for a given city to detect on performance DOE

N83-21605# Boeing Computer Services, Inc., Seattle, Wash.
**INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION
EXPERIMENT OPERATIONAL PERFORMANCE REPORT FOR
CDC LIGHT MANUFACTURING BUILDING, SAN BERNARDINO,
CALIFORNIA**

Oct. 1982 23 p refs
(Contract DE-AC04-76DP-00789)
(DE83-002529, SAND-81-7089/4) Avail NTIS HC A02/MF A01

The data are presented that were accumulated during June at the intermediate photovoltaic project at the CDC Light Manufacturing Building, San Bernardino, California. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided. DOE

N83-21606# Boeing Computer Services, Inc., Seattle, Wash.
**INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION
EXPERIMENT OPERATIONAL PERFORMANCE REPORT FOR
OKLAHOMA CENTER FOR SCIENCE AND ARTS FOR JUNE,
JULY, AND AUGUST 1982**

Nov. 1982 70 p refs
(Contract DE-AC04-76DP-00789)
(DE83-003668, SAND-81-7087/4) Avail NTIS HC A04/MF A01

Presented are the data accumulated during June, July, and August at the intermediate photovoltaic project at Oklahoma Center for Science and Arts, Oklahoma City, Oklahoma. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided. DOE

N83-21607# TrnSolar Corp., Bedford, Mass
**DESIGN AND FABRICATION OF A PROTOTYPE SYSTEM FOR
PHOTOVOLTAIC RESIDENCES IN THE SOUTHWESTERN
UNITED STATES Final Report**

A MILLNER Aug 1982 80 p
(Contract DE-AC02-76ET-20279)
(DE83-002532, DOE/ET-20279/218) Avail NTIS HC A05/MF
A01

The intention of the project reported was to develop plans for an energy-efficient residence for the southwestern region of the country, and to design into it a roof-mounted photovoltaic (PV) solar electric power system which would allow two-way power flow between the utility grid and the house. A full-scale working prototype of the PV system was built to evaluate the performance of that system for one year. The residence design, the prototype construction, and the fabrication history through the first year of operation are described. DOE

N83-21613# Sandia Labs., Albuquerque, N. Mex
**RESULTS OF THE PRDA 35 QUALIFICATION TESTS OF THE
BDM CONCENTRATING PHOTOVOLTAIC MODULE**

T. D. HARRISON Aug 1982 29 p refs
(Contract DE-AC04-76DP-00789)
(DE83-002136, SAND-82-0732) Avail NTIS HC A03/MF A01

During the period March 30 to October 30, 1981 two concentrators and eight module sections from an actively cooled, concentrating photovoltaic array were tested. Two different concentrators were used during the test program. Physical, electrical, and thermal characteristics as well as electrical performance data are presented. The effects of temperature cycling and freeze-thaw cycling exposure tests are given. Results presented revealed problems that are being corrected so that the module used to build the array will meet the qualification goals. DOE

N83-21614# Lamar Univ, Beaumont, Tex. Dept of Mechanical
Engineering.

**VENTILATED WALL AND WINDOW TEST PASSIVE-SOLAR
CONCEPT Final Report**

H. T. MEI 1 Feb. 1982 44 p refs
(DE83-900824; TENRAC/EDF-063) Avail NTIS HC A03/MF
A01

The ventilated wall is composed of hollow blocks through which air may flow, a duct system with a fan, and for the pre-cooled vented wall, a system for circulating well water. The performance results of the pre-cooled vent wall are briefly summarized. A vented wall and roof configuration is also described. An economic analysis of the vented wall is presented. A facility for testing the performance of window designs and configurations is described, and the effectiveness of glass, multiple glazing, reflective glass, exterior appendages and interior appliances is discussed. DOE

N83-21615# Energy Engineering, Inc., Albuquerque, N. Mex
**ADDITIONAL TESTING OF THE PASSIVE HEAT-PIPE-COOLED
SOLAR PHOTOVOLTAIC RECEIVER**

K. T. FELDMAN, JR and D. D. KENNEY Nov 1982 55 p
refs
(Contract DE-AC04-76DP-00789)
(DE-83-004474; SAND-81-7180) Avail NTIS HC A04/MF A01

A heat exchanger which was designed to cool the cells in a linear concentrating solar photovoltaic module is described. The heat exchanger used an evaporating fluid to carry heat away from the surface, where cells would be mounted, and to a finned heat exchange surface. It was similar in operation to a heat pipe. It is concluded that this type of cooling is not a viable method for cooling photovoltaic cells. DOE

N83-21618# Science Applications, Inc., McLean, Va
**ASSESSMENT OF DISTRIBUTED SOLAR POWER SYSTEMS:
ISSUES AND IMPACTS Final Report**

R. A. MOYLE, H. CHERNOFF, T. C. SCHWEIZER, and J. B.
PATTON (Systems Control, Inc., Palo Alto, Calif.) Nov. 1982
174 p refs
(Contract EPRI PROJ 1995-1)

(DE83-900640; EPRI-AP-2636) Avail NTIS HC A08/MF A01
The installation of distributed solar-power systems presents electric utilities with a host of questions. Some of the technical and economic impacts of these systems are discussed. Among the technical interconnect issues are isolated operation, power quality, line safety, and metering options. Economic issues include user purchase criteria, structures and installation costs, marketing and product distribution costs, and interconnect costs. An interactive computer program that allows easy calculation of allowable system prices and allowable generation-equipment prices was developed as part of this project. It is concluded that the technical problems raised by distributed solar systems are surmountable, but their resolution may be costly. The stringent purchase criteria likely to be imposed by many potential system users and the economies of large-scale systems make small systems (less than 10 to 20 kW) less attractive than larger systems. Utilities that consider life-cycle costs in making investment decisions

and third-party investors who have tax and financial advantages are likely to place the highest value on solar-power systems

N83-21620# Midwest Research Inst., Golden, Colo Thermal Systems and Engineering Branch
DESIGN APPROACHES FOR SOLAR INDUSTRIAL PROCESS-HEAT SYSTEMS: NONTRACKING AND LINE-FOCUS COLLECTOR TECHNOLOGIES
 C F KUTSCHER, R L DAVENPORT, D A DOUGHERTY, R C GEE, P M MASTERSON, and E K MAY Aug. 1982 457 p refs
 (Contract DE-AC02-77CH-00178, EG-77-C-01-4042)
 (DE83-003339, SERI/TR-253-1356) Avail: NTIS HC A20/MF A01

The design methodology for solar industrial process heat systems is described, and an overview is given of the use of solar energy in industry. A way to determine whether solar energy makes sense for a particular application is described. The basic system configurations used to supply hot water or steam are discussed, and computer generated graphs are supplied that allow the user to select a collector type. Energy calculations are provided, including the effects of thermal losses and storage. The selection of subsystem components is described, and control systems, installation and start up details, economics, and safety and environmental issues are explained. DOE

N83-21625# Olin Corp., Stamford, Conn.
MANUFACTURE, DISTRIBUTION, AND HANDLING OF NITRATE SALTS FOR SOLAR-THERMAL APPLICATIONS
 L C FIORUCCI and S L GOLDSTEIN Nov. 1982 125 p refs
 (Contract DE-AC04-76DP-00789)
 (DE83-003317, SAND-81-8186) Avail: NTIS HC A06/MF A01

The low cost and attractive physical properties of molten sodium/potassium nitrate salts were shown to be one of the most cost effective fluids for heat absorption and thermal energy storage in Solar Central Receiver (SCR) systems. Information related to the availability, transport, handling, and utilization of these salts for commercial size SCR applications is provided. The following items are reviewed: existing manufacturing processes for natural and synthetic nitrates, the upstream availability of raw materials; downstream existing and projected demand for these products in other sectors of the economy, and relevant handling and distribution technologies. Safety considerations and issues more directly related to the SCR facility, such as initial system charging, salt maintenance and regeneration, and disposal are also reviewed. Options for supply, surge storage, and initial charging are discussed for the 1 MWt to 300 MWe range of solar plant sizes. DOE

N83-21626# Oak Ridge National Lab., Tenn. Energy Div.
PERFORMANCE AND ECONOMICS OF RESIDENTIAL SOLAR SPACE HEATING
 F J ZEHR (Westminster Coll., New Wilmington, Pa.), T. A. VINEYARD, R W BARNES, and D L ONEAL Nov. 1982 224 p refs
 (Contract W-7405-ENG-26)
 (DE83-003187, ORNL/CON-70) Avail: NTIS HC A10/MF A01

The performance and economics of residential solar space heating were studied for various locations in the contiguous United States. Common types of active and passive solar heating systems were analyzed with respect to an average-size, single-family house designed to meet or exceed the thermal requirements of the Department of Housing and Urban Development Minimum Property Standards (HUD-MPS). The solar systems were evaluated in seventeen cities to provide a broad range of climatic conditions. Active systems evaluated consist of air and liquid flat plate collectors with single- and double-glazing. Passive systems include Trombe wall, water wall, direct gain, and sunspace systems. The active system solar heating performance was computed using the University of Wisconsin's F-CHART computer program. The Los Alamos Scientific Laboratory's Solar Load Ratio (SLR) method was employed to compute solar heating performance for the passive systems. Heating costs were computed with gas, oil, and

electricity as backups and as conventional heating system fuels. DOE

N83-21627# Research Triangle Inst., Research Triangle Park, N.C.
PHOTOVOLTAIC CELL AND MODULE STATUS ASSESSMENT. VOLUME 2: TECHNOLOGY BASIS. Final Report
 J. W. HARRISON Oct 1982 167 p refs
 (Contract EPRI PROJ. 1975-1)
 (DE83-900575, EPRI-AP-2473-VOL-2) Avail: NTIS HC A08/MF A01

A series of in-depth appendices covers the basics of photovoltaic technology, including the nature and availability of sunlight, physical basis of photovoltaic cell operation, basic photovoltaic cell design features, photovoltaic cell equivalent circuits and parameters, photovoltaic cell design for applications, photovoltaic cell fabrication technologies, cell test methods, flat-plate module design, flat-plate module fabrication, flat-plate module performance testing, concentrator module design, concentrator module development and evaluation, a glossary, and a list of manufacturers of photovoltaic cells, modules, and systems. DOE

N83-21634# Varian Associates, Palo Alto, Calif. Solid State Lab
DESIGN AND DEMONSTRATION OF A SPECTRUM-SPLITTING PHOTOVOLTAIC CONCENTRATOR MODULE
 P G BORDEN, P E GREGORY, and O E. MOORE Nov. 1982 63 p refs
 (Contract DE-AC04-76DP-00789)
 (DE83-003669, SAND-82-7120) Avail: NTIS HC A04/MF A01

A spectrum splitting, concentrating photovoltaic module has been designed and fabricated that uses point focus curved facet Fresnel lenses to concentrate incident sunlight. The concentrated sunlight beam spectrum is split into a high and low energy part by a dichroic filter. The high energy part of the spectrum is transmitted to an AlGaAs solar cell and the low energy part is reflected to a Si cell. Spectrum splitting and using cells that respond best to the two parts of the spectrum splitting and using cells that respond best to the two parts of the spectrum gives a higher efficiency than the use of either cell alone. The experimental module has been tested which consists of 10 AlGaAs and 10 Si cells, and a sunlight to electricity conversion efficiency of 20% has been measured. DOE

N83-21635# Argonne National Lab., Ill. Energy and Environmental Systems Div.
RELIABILITY AND DESIGN GUIDELINES FOR COMBINED SOLAR-SPACE-HEATING AND DOMESTIC HOT-WATER SYSTEM
 R. M. WOLOSEWICZ and J. VRESK Jul 1982 79 p refs
 (Contract W-31-109-ENG-38)
 (DE83-003341, ANL/SDP-12) Avail: NTIS HC A05/MF A01

Concepts of combined solar space-heating and domestic hot water (DHW) systems, and techniques for development of such systems are summarized for engineers and designers. Minimum instrumentation requirements for determining whether such system are operating properly are discussed, as are start-up and trouble shooting. Flat plate and tubular collector modules and generic drain-back systems that use them are analyzed by means of block-type reliability diagrams. System reliability results, based on a 6 h/d duty cycle, are given for five collector array sizes, in terms of mean time between failures. The duty-cycle analysis approach can be similarly applied to other operating cycles. DOE

02 SOLAR ENERGY

N83-21637# Mission Research Corp., Albuquerque, N. Mex.
ELECTRICAL OVERSTRESS FAILURE IN SILICON SOLAR CELLS Final Report

R. L. PEASE, J. R. BARNUM, V. A. J. VANLINT, W. V. VULLIET, and T. F. WROBEL (Sandia Labs., Albuquerque, N. Mex.) Nov. 1982 229 p refs

(Contract DE-AC04-76DP-00789)

(DE83-004475; SAND-82-7128; ARMC-R-358) Avail: NTIS HC A11/MF A01

A solar-cell electrical-overstress-failure model and the results of experimental measurements of threshold pulsed failure currents on four types of silicon solar cells are presented. The transient electromagnet pulse field surrounding a lightning stroke was identified as a potential threat to a photovoltaic array, yet failure analysis of solar cells in a pulsed environment had not previously been reported. Failure in the low-resistivity concentrator cells at pulse widths between 1 SIGMA and 1 ms occurred initially in the junction. Finger damage in the form of silver melting occurs at currents only slightly greater than that required for junction damage. The result of reverse-bias transient-overstress tests on high-resistivity (10 LAMBDA cm) cells demonstrated that the predominant failure mode was due to edge currents. These flat-plate cells failed at currents of only 4 to 20 A, which is one or two orders of magnitude below the model predictions. It thus appears that high-resistivity flat-plate cells are quite vulnerable to electrical overstress which could be produced by a variety of mechanisms DOE

N83-21642# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.

OPTIMIZATION OF SOLAR-SELECTIVE PAINT COATINGS Final Report, 15 Sep. 1980 - 15 Jun. 1982

M. A. MCCHESENEY, P. B. ZIMMER, and R. J. H. LIN Jun. 1982 69 p refs

(Contract DE-AC04-78CS-14287)

(DE83-001278; DOE/CS-14287/T2) Avail: NTIS HC A04/MF A01

The objective was the development of low-cost, high-performance, solar-selective paint coatings for solar flat-plate collector (FPC) use and passive thermal wall application. Thickness-sensitive selective paint coating development was intended to demonstrate large scale producibility. Thickness-insensitive selective paint (TISP) coating development was intended to develop and optimize the coating for passive solar systems and FPC applications. Low-cost, high-performance TSSP coatings and processes were developed to demonstrate large-scale producibility and meet all program goals. Dip, spray, roll, laminating and gravure processes were investigated and used to produce final samples. High-speed gravure coating was selected as the most promising process for solar foil fabrication. Development and optimization of TISP coatings was not completely successful. A variation in reflective metal pigment was suspected of being the primary problem, although other variables may have contributed. Consistent repeating of optical properties of these coatings achieved on the previous program was not achieved. DOE

N83-21643# Brookhaven National Lab., Upton, N. Y. Solar and Renewables Div.

DEVELOPMENT OF POLYMER FILM SOLAR COLLECTORS: A STATUS REPORT

W. G. WILHELM and J. W. ANDREWS Aug 1982 29 p refs

(Contract DE-AC02-76CH-00016)

(DE83-005995; BNL-51582) Avail: NTIS HC A03/MF A01

Solar energy collector panels using polymer film and laminate technology were developed which demonstrate low cost and high thermal performance for residential and commercial applications. This device uses common water in the absorber/heat exchanger which is constructed with polymer film adhesively laminated to aluminum foil as the outer surfaces. Stressed polymer films are also used for the outer window and back surface of the panel forming a high strength structural composite. Rigid polymer foam complements the design by contributing insulation and structural

definition. This design resulted in very low weight (3.5 kg/m²), potentially very low manufacturing cost (approx \$11/m²), and high thermal performance. The development of polymer materials for this technology will be a key to early commercial success DOE

N83-21722# Vitro Labs., West Orange, N.J.
SEPTEMBER 1982 ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK

Sep. 1982 65 p

(Contract DE-AC01-79CS-30027)

(DE83-001839; SOLAR/0010-82/09) Avail: NTIS HC A04/MF A01

Environmental data are tabulated for 14 sites. The data include insolation, temperature, wind, and relative humidity data. Also included is a technical discussion of the instruments used in taking the data DOE

N83-22407# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

THERMAL-CONVECTION-LOOP STUDY OF THE CORROSION OF FE-NI-CR ALLOYS BY MOLTEN NANO/SUB 3-KNO/SUB 3

P. F. TORTORELLI and J. H. DEVAN Dec. 1982 42 p refs

(Contract W-7405-ENG-26)

(DE83-004228; ORNL/TM-8298) Avail: NTIS HC A03/MF A01

The corrosion of Fe-Ni-Cr alloys by draw salt (60 wt % NaNO₃-40 wt % KNO₃) is studied with thermal convection loops of alloy 800 and types 304L and 316 stainless steel. The main corrosion processes at 6000 C and below were the growth of thin oxide scales and the dissolution of chromium by the salt. Spallation of oxide layers occurred on type 304 stainless steel specimens at intermediate temperatures. Results indicated relatively low corrosion rates (13 (SIGMA)m/year in most cases) for temperatures of 6000 C and less. Corrosion of type 316 stainless steel was greatly accelerated when the maximum loop temperature was raised to 6200 C. It therefore appears that 6000 C may be the limiting temperature for use of the above alloys in draw salt. DOE

N83-22510# McGraw-Hill Book Co., Inc., New York
POWER FACTOR CONTROLLERS

1982 4 p

Avail: NTIS HC A02/MF A01

The power factor controller (PFC) is a solid state electronic device that reduces excessive energy waste in ac induction motors. The significance of the PFC lies in the fact that nearly a billion induction motors are used daily. The PFC is applicable to both single phase and three phase induction motors. Since it is connected to the power lines of the motor and requires no modification to the motor itself, it may be applied to existing motors as well as to new installations BG

N83-22534# Lincoln Lab., Mass Inst of Tech., Lexington Electric Power Systems Engineering Lab

PHOTOVOLTAIC I-5 CURVE MEASUREMENT TECHNIQUES

C. H. COX and T. H. WARNER Aug 1982 26 p refs

(Contract DE-AC02-76ET-20279)

(DE83-000447; DOE/ET-20279/215) Avail: NTIS HC A03/MF A01

Performance evaluation of photovoltaic (PV) arrays under actual field conditions provides important feedback to the module design process. One of the principal methods for assessing an array's performance is to plot its current, I, versus voltage, V, curve. Following a brief review of techniques for measuring the I-V curve, a new, capacitive-based approach is presented. It uses a rapid sweep of the I-V curve that substantially reduced the average power transfer between array and load, and in turn, substantially reduced the size and weight of the curve tracer. Both theoretical and practical aspects of the approach are presented for a 10-kW unit. Performance is verified by comparison with I-V curves obtained by using a conventional load. The agreement is found to be excellent. Approximately an order of magnitude reduction in size, weight and power consumption over conventional units was realized with the experimental I-V curve tracer. DOE

N83-22567# Hahn-Jackson-Thresher-Henning, Inc., Evansville, Ind

SOLAR-ASSISTED WATER-SOURCE HEAT PUMP

31 Mar 1982 4 p

(Contract DE-FG02-81R5-10298)

(DE82-013981; DOE/R5-10298/1) Avail: NTIS HC A02/MF A01

The usefulness of a collector array is to be extended to year-round usage by using the collectors to reject heat at night during the summer. A water source heat pump is used to cool a home by rejecting heat to water which is then held in a storage tank. At night the warm water is pumped through the collectors for radiative cooling. Two complete systems are being installed to demonstrate feasibility. One part of the system has been completed and tested. DOE

N83-22599# Sandia Corp., Livermore, Calif. Materials Science Div

THERMAL FATIGUE TESTS OF SOLAR ONE RECEIVER-TUBE WELDMENTS

D. A. HUGHES Mar. 1982 33 p refs

(Contract DE-AC04-76DP-00789)

(DE82-012520, SAND-82-8206) Avail: NTIS HC A03/MF A01

Tubing for solar receiver panels is joined by longitudinal welds using a low heat input welding process. Concern existed that lack of fusion defects (crack-like notches at the root of the weld) created by this welding process would propagate during diurnal thermal cycling. If crack propagation occurred at these defects, it could shorten the life of the receiver tube panels. An experiment which simulated key elements of the receiver cyclic thermal strain environment was designed to address this concern. During the experiment, receiver tube weldments (welds prepared, in the laboratory) were thermally cycled for 15,000 cycles. They were subsequently examined metallographically for crack propagation. Results of this examination revealed that no crack propagation occurred during the test. DOE

N83-22741*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div

LIGHTWEIGHT SOLAR ARRAY BLANKET TOOLING, LASER WELDING AND COVER PROCESS TECHNOLOGY Final Report

P. A. DILLARD Jan 1983 51 p refs

(Contract NAS7-918, JPL-956020)

(NASA-CR-170209, NAS 1.26 170209, LMSC-D843530) Avail: NTIS HC A04/MF A01 CSCL 10A

A two phase technology investigation was performed to demonstrate effective methods for integrating 50 micrometer thin solar cells into ultralightweight module designs. During the first phase, innovative tooling was developed which allows lightweight blankets to be fabricated in a manufacturing environment with acceptable yields. During the second phase, the tooling was improved and the feasibility of laser processing of lightweight arrays was confirmed. The development of the cell/interconnect registration tool and interconnect bonding by laser welding is described. S.L.

N83-22742*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Electrical Power Systems Lab

DEVELOPMENT OF TECHNOLOGIES FOR WELDING INTERCONNECTS TO FIFTY-MICRON THICK SILICON SOLAR CELLS Interim Report, 14 May 1981 - Dec. 1982

R. E. PATTERSON Dec 1982 67 p refs

(Contract NAS7-918, JPL-956042)

(NASA-CR-170212, JPL-9950-806, NAS 1.26 170212, TRW-38512.000) Avail: NTIS HC A04/MF A01 CSCL 10A

A program was conducted to develop technologies for welding interconnects to 50 microns thick, 2 by 2 cm solar cells. The cells were characterized with respect to electrical performance, cell thickness, silver contact thickness, contact waviness, bowing, and fracture strength. Weld schedules were independently developed for each of the three cell types and were coincidentally identical. Thermal shock tests (100 cycles from 100 C to -180 C) were performed on 16 cell coupons for each cell type without any

weld joint failures or electrical degradation. Three 48 cell modules (one for each cell type) were assembled with 50 microns thick cells, frosted fused silica covers, silver clad Invar interconnectors, and Kapton substrates. Author

N83-22744*# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering

THE STRUCTURE OF 110 TILT BOUNDARIES IN LARGE AREA SOLAR SILICON Annual Report, 31 Aug. 1981 - Sep. 1982

D. G. AST, B. CUNNINGHAM, and M. VAUDIN Dec 1982 24 p refs

(Contract JPL-956046)

(NASA-CR-170204; DOE/JPL-956046-82/5; NAS 1.26 170204, AR-5) Avail: NTIS HC A02/MF A01 CSCL 10A

The models of Hornstra and their connection to the repeating group description of grain boundaries (7-10) are discussed. A model for the Sigma = 27 boundary containing a zig-zag arrangement of dislocations is constructed and it is shown that zig-zag models can account for the contrast features observed in high resolution transmission electron micrographs of second and third order twin boundaries in silicon. The boundaries discussed are symmetric with a 110 tilt axis and a (110) boundary plane in the median lattice (the median plane). The median lattice is identical in structure and halfway in orientation between the crystal lattices either side of the boundary. Author

N83-22745*# Mobil Tyco Solar Energy Corp., Waltham, Mass. **STRESS STUDIES IN EFG Quarterly Progress Report, 1 Oct. - 31 Dec. 1982**

15 Feb 1983 22 p refs

(Contract JPL-956312)

(NASA-CR-170205, JPL-9950-810, DOE/JPL-956312-83/02; NAS 1.26 170205, QPR-2) Avail: NTIS HC A02/MF A01 CSCL 10A

A computer code which can account for plastic deformation effects on stress generated in silicon sheet grown at high speeds is fully operative. Stress and strain rate distributions are presented for two different sheet temperature profiles. The calculations show that residual stress levels are very sensitive to details of the cooling profile in a sheet with creep. Experimental work has been started in several areas to improve understanding of ribbon temperature profiles and stress distributions associated with a 10 cm wide ribbon cartridge system. Author

N83-22756*# TRW Space Technology Labs., Redondo Beach, Calif.

STUDY OF SOLAR ARRAY SWITCHING POWER MANAGEMENT TECHNOLOGY FOR SPACE POWER SYSTEM Final Report

J. E. CASSINELLI Sep. 1982 240 p refs

(Contract NAS3-22656)

(NASA-CR-167890; NAS 1.26 167890, TRW-3724) Avail: NTIS HC A11/MF A01 CSCL 10A

This report documents work performed on the Solar Array Switching Power Management Study. Mission characteristics for three missions were defined to the depth necessary to determine their power management requirements. Solar array switching concepts which could satisfy the mission requirements were identified. The switching concepts were compared with a conventional buck regulator system for cost, weight and volume, reliability, efficiency and thermal control. Solar array switching provided significant advantages in all areas of comparison for the reviewed missions. E. A. K.

N83-22774# Sandia Labs., Albuquerque, N. Mex. **INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE REPORT: VOLUME 5, FOR BEVERLY HIGH SCHOOL, BEVERLY, MASS.**

Feb 1982 30 p

(Contract DE-AC04-76DP-00789)

(DE82-012058, SAND-81-7088/5) Avail: NTIS HC A03/MF A01

Performance data for the month of January, 1982 for a grid connected photovoltaic power supply in Massachusetts are presented. Data include: monthly and daily electrical energy produced; monthly and daily solar energy incident on the array,

02 SOLAR ENERGY

monthly and daily array efficiency, plots of energy produced as a function of power level, voltage, cell temperature and time of day, power conditioner input, output and efficiency for each of two individual units and for the total power conditioning system; photovoltaic system efficiency; capacity factor, PV system to load and grid to load energies and corresponding dollar values, daily energy supplies to the load by the PV system, daily PV system availability; monthly and hourly insolation, monthly and hourly temperature average, monthly and hourly wind speed, wind direction distribution; average heating and cooling degree days, number of freeze/thaw cycles, and the data acquisition mode and recording interval plot
GRA

N83-22776# Sandia Labs, Albuquerque, N Mex Experimental Systems Operations Div.

PROGRAM FOR PREDICTING THERMAL PERFORMANCE BASED ON TEST DATA OF LOW- TO MEDIUM-TEMPERATURE LINE-FOCUSING, CONCENTRATING SOLAR COLLECTORS

T D HARRISON Feb 1982 20 p refs

(Contract DE-AC04-76DP-00789)

(DE82-012605, SAND-82-0092/1) Avail NTIS HC A02/MF A01

A program for predicting the performance of line focusing solar collectors that can be used in low to medium temperature applications such as domestic water heaters is described. The program has two purposes (1) to make predictions of thermal performance in various locations and (2) to provide manufacturers of each collector with an opportunity to determine the effectiveness of design changes of their choosing. The testing program is outlined. The computer program for performance predictions is described
DOE

N83-22777# Sandia Labs, Albuquerque, N Mex. Photovoltaic Concentrator Technology Div

THERMAL-RECEIVER DESIGNS FOR LINE-FOCUS SOLAR COLLECTORS

C. J. CHIANG Feb. 1982 14 p refs

(Contract DE-AC04-76DP-00789)

(DE82-012067, SAND-81-1862) Avail NTIS HC A02/MF A01

The potential to increase the annual efficiency of line focus collectors by reducing receiver heat loss was studied. Five alternate receiver designs are compared with a standard design. The comparison is based on annual collector field efficiency using optimized receiver designs. It is found that the all-glass design and the cavity design provide the greatest increases in efficiency. Average fluid temperatures range from 200 to 450 C
DOE

N83-22791# Research Triangle Inst., Research Triangle Park, NC

PHOTOVOLTAIC CELL AND MODULE STATUS ASSESSMENT. VOLUME 1: TECHNOLOGY OVERVIEW Final Report

J W HARRISON Oct 1982 110 p refs

(Contract EPRI PROJ. 1975-1)

(DE83-900567, EPRI-AP-2473-VOL-1) Avail: NTIS HC A06/MF A01

The current technology status of photovoltaic (PV) cells and modules is assessed. The path of development from research concept through intermediate stages, such as prototype development, to routine production is characterized by an increasing definition of physical form, function, performance and cost. At this time conversion efficiency is the most important measure of technical status in each of the development stages. Efficiency is used in this study as the primary comparative indicator. Over the near term, flat plate modules based on silicon PV cells will dominate commercial availability due to the extensive industrial experience with silicon and the emphasis placed on this material in the Federal program. Both silicon and gallium arsenide based cells with dominate concentrator module development and demonstration efforts are discussed. Many other materials and device designs are being pursued, but much remains to be done to bring efficiency and stability up to the levels demonstrated in the silicon and gallium arsenide devices for use in either flat plate or concentrator modules
DOE

N83-22795# Texas Univ., Austin School of Architecture.

INTEGRATED PASSIVE-SOLAR DEMONSTRATION PROJECT Final Report

M L GARRISON Sep 1982 105 p refs

(DE83-900807; TENRAC/EDF-081) Avail NTIS HC A06/MF A01

The objectives were to collect data on a combination of several passive solar heating and cooling systems. A passive solar test structure was constructed and monitored and the demonstration of passive systems designed into the structure was evaluated. Passive solar cooling principles include shading all mass walls and windows from direct solar gain, maintaining cool attic and ceiling temperatures using solar induced ventilation, maintaining cool mean radiant wall temperatures, recirculating internal air, and using natural cross-ventilation throughout the conditioned space in spring and fall. Passive solar heating principles include: orientation of windows and sunspaces towards the south, providing double pane south windows, providing a double pane solar sunspace, using night insulation over glazing, extended thermal storage mass, and using a fan-forced rock/earth/air storage system
DOE

N83-22796# Burt, Hill, Kosar, Rittleman, and Associates, Butler, Pa. Research and Solar Applications Div

AUTOMATED INSTALLATION METHODS FOR PHOTOVOLTAIC ARRAYS

R BRIGGS, A DANIELS, R. GREENAWAY, J OSTER, JR., D RACKI, and R STOELTZING Nov 1982 232 p refs

(Contract DE-AC04-76DP-00789)

(DE83-004272, SAND-81-7192) Avail: NTIS HC A11/MF A01

Since installation expenses constitute a substantial portion of the cost of a large photovoltaic power system, methods for reduction of these costs were investigated. The installation of the photovoltaic arrays includes all areas, starting with site preparation (i.e., trenching, wiring, drainage, foundation installation, lightning protection, grounding and installation of the panel) and concluding with the termination of the bus at the power conditioner building. To identify the optimum combination of standard installation procedures and automated/mechanized techniques, the installation process was investigated including the equipment and hardware available, the photovoltaic array structure systems and interfaces, and the array field and site characteristics. Preliminary designs of hardware for both the standard installation method, the automated/mechanized method, and a mix of standard installation procedures and mechanized procedures were identified to determine which process effectively reduced installation costs. In addition, costs associated with each type of installation method and with the design, development and fabrication of new installation hardware were generated
DOE

N83-22797# Arizona Scientific Research, Tucson

PERFORMANCE OPTIMIZATION OF THE ASR OPTICAL MODULE

W MEINEL, E MEINEL, and A B. MEINEL Nov 1982 183 p

(Contract DE-AC04-76DP-00789)

(DE83-004477; SAND-82-7124) Avail NTIS HC A09/MF A01

The design, construction, and testing of a photovoltaic concentrating collector module using a dish shaped reflector is described. The reflector is 83 meters in diameter and provides sunlight at a geometric concentration intensity of 50 suns to an actively cooled cylindrical receiver. Six prototype modules were fabricated using reflectors made of a fiberglass reinforced plastic. The maximum electrical efficiency measured was 8.4 percent. Design considerations included the effects of reflector design, receiver size and location, reflective surface errors, alignment errors, and tracking errors on receiver flux distribution. Flux profiles were measured and the shape of the reflectors was determined by using an automated method. An estimate of the costs based on a production version of the design gave an installed energy cost of \$3.42 per peak watt
DOE

N83-22798# Energy Technology Engineering Center, Canoga Park, Calif

SOLAR-COLLECTOR SILICON HOSE LIFE TEST

H F DONOHUE and R. L. MORSE 11 Aug. 1982 13 p

(Contract DE-AC03-76SF-00700)

(DE83-002236, ETEC-TDR-82-13) Avail NTIS HC A02/MF A01

A life-cycle test of the recommended silicone hose installation was performed to verify that this configuration would protect the integrity of the system. The test rig was filled with inhibited water which was circulated through the test article. The water was alternately heated and pressurized and then cooled to simulate day and night operation in Arizona. The test indicated that the recommended modification would provide an economic and long-range solution to the problem. DOE

N83-22799# EIC, Inc., Newton, Mass.

USE OF INORGANIC MATERIALS FOR PHOSPHORESCENT CONCENTRATING SOLAR CELLS

P. O. OFFENHARTZ, R. H. MICHEELS, and A. D. DARROW Apr 1982 35 p refs

(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)

(DE83-002860; SERI/TR-8041-13-T1) Avail NTIS HC A03/MF A01

It has been demonstrated that phosphorescent transition metal complexes can provide a solution to the problem of reabsorption of luminescence in Luminescent Solar Collection (LSC) dyes. The major difficulty encountered in the development of such inorganic dyes was insufficiently high phosphorescence quantum yields. The highest yields measured were too low by a factor of 3 or more. The major effort in the program was directed at obtaining higher quantum yields. One promising metal-porphyrin complex, Pt-(EtIO), which should have a room temperature quantum yield of about 0.7 according to literature reports, was only partially evaluated. GRA

N83-22808# North Carolina State Univ., Raleigh Dept of Mechanical and Aerospace Engineering.

FIRST YEAR'S PERFORMANCE DATA OF THE NCSU SOLAR ENERGY AND CONSERVATION HOUSE

Nov. 1982 23 p

(Contract DE-AC02-82CH-10116, DOE-1250-C-410-0082)

(DE83-004800, DOE/CH-10116/1) Avail NTIS HC A02/MF A01

A solar energy and conservation house is described. It has 2000 square feet of floor area and contains a two-story embedded sunspace, two Trombe walls, active solar hot water heating for domestic use, thermal storage in a rock filled ceiling/floor, and numerous research treatments, and energy conservation features. The house is completely decorated and furnished in an attractive manner and the exterior architecture is traditional and has broad consumer appeal. The house is open to the public on weekdays and numerous people and various groups come to visit on their own initiative and others take advantage of the close proximity to McKimmon while attending conferences there. The overall thermal performance of the house greatly exceeds initial predictions and expectations. For instance, only 660 kWh of electricity (cost of \$39.60 in 1981 to 1982) were used by the heat pump to heat the house for the entire winter of 1981 to 1982. That winter season experienced 3554 heating degree days and consequently such a low heating consumption represents truly remarkable thermal performance and design. Similarly, the house performed well during a typically hot and humid summer in central North Carolina. The heat pump consumed 1157 kWh of electricity (\$69.42) for the entire summer of 1982. DOE

N83-22809# Trinity Univ., San Antonio, Tex.

SOLAR-REGENERATED DESICCANT DEHUMIDIFICATION Final Report

P. HAVES 9 Feb. 1982 146 p refs

(Contract TENRAC PROJ 80-S-1-3)

(DE83-900823, RENRAC/EDF-064) Avail NTIS HC A07/MF A01

The dehumidification requirements of buildings are discussed, and the most suitable desiccant material is identified as silica gel. Several conceptual designs for solar regenerated desiccant dehumidifiers using a solid desiccant are described. The construction and operation of a laboratory experiment to determine the performance of a packed bed of silica gel at low flow rate is described. The experimental results are presented and compared to the predictions of a simple computer model which assumes local equilibrium between the desiccant and the airstream. The simulations used to predict desiccant bed performance and the integration of the desiccant bed simulation with a simulation of the thermal performance of a passively cooled residence are described. Results for an average July day are presented. Sizing relationships derived from the simulation are described, and an economic analysis and recommendations for further work are presented. DOE

N83-22814# Midwest Research Inst., Golden, Colo Solar Energy Conversion Research Div.

PHOTOVOLTAIC ADVANCED RESEARCH AND DEVELOPMENT PROGRAM IN THE UNITED STATES

J. L. STONE, D. W. RITCHIE, T. SUREK, and C. E. WITT Sep 1982 12 p refs Presented at the 4th Photovoltaic Solar Energy Conf., Stresa, Italy, 10-14 May 1982

(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)

(DE83-000307, SERI/TP-211-1609; CONF-820555-5) Avail NTIS HC A02/MF A01

The major thrust of the Advanced Research and Development Subprogram is to achieve technical feasibility for various advanced material technologies through long term, high risk, and potentially high payoff research and development. Two approaches are being pursued in order to achieve the cost and efficiency goals. One is to research various polycrystalline and amorphous thin film semiconducting materials on low cost substrates. The other approach is to use solar concentrators in the form of either high efficiency multibandgap cells having 20-40% efficiency potential or luminescent collectors. Polycrystalline thin films under development include polycrystalline silicon, II-VI compounds such as CdS and CdTe and III-V compounds such as GaAs. Also included are photoelectrochemical cells with polycrystalline photoelectrodes. The technical approaches, funding, and future activities are described for each area of research. DOE

N83-22818# Texas Univ., Austin School of Architecture

PASSIVE-SOLAR HOMES FOR TEXAS

M. L. GARRISON 1982 188 p refs

(DE83-900806, TENRAC/EDF-082) Avail NTIS HC A09/MF A01

Acceptance of passive solar technologies has been slow within the conventional building trades in Texas because it is a common misconception that solar is expensive, and data on local applications is severely limited or nonexistent. It is the purpose of this solar development to move passive solar design into the mainstream of public acceptance by helping to overcome and eliminate these barriers. Specifically, the goal is to develop a set of regional climatic building standards to help guide the conventional building trade toward the utilization of soft energy systems which will reduce overall consumption at a price and convenience most Texans can afford. To meet this objective, eight sample passive design structures are presented. These designs represent state of the art regional applications of passive solar space conditioning. The methodology used in the passive solar design process included analysis of regional climatic data, analysis of historical regional building prototypes; determination of regional climatic design priorities and assets; prototypical design models for the discretionary housing market, quantitative thermal analysis

02 SOLAR ENERGY

of prototypical designs; and construction drawings of building prototypes. DOE

N83-22819# Boeing Computer Services, Inc., Seattle, Wash
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE REPORT. VOLUME 1: DALLAS - FORT WORTH REGIONAL AIRPORT, TEXAS, JULY 1982

Nov. 1982 27 p refs
(Contract DE-AC04-76DP-00789)
(DE83-004763; SAND-81-7083/1) Avail: NTIS HC A03/MF A01

The data accumulated during July at the intermediate photovoltaic project at Dallas-Fort Worth Regional Airport, Texas are presented. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided. DOE

N83-22822# Solarex Corp., Rockville, Md.
SILICON CONCENTRATOR CELL-ASSEMBLY DEVELOPMENT

Aug. 1982 71 p refs
(Contract DE-AC04-76DP-00789)
(DE83-001683; SAND-80-7075) Avail: NTIS HC A04/MF A01

The purpose was to develop an improved cell assembly design for photovoltaic concentrator receivers. Efforts were concentrated on a study of adhesive/separator systems that might be applied between cell and substrate, because this area holds the key to improved heat transfer, electrical isolation and adhesion. It is also the area in which simpler construction methods offer the greatest benefits for economy and reliability in the manufacturing process. Of the ten most promising designs subjected to rigorous environmental testing, eight designs featuring acrylic and silicon adhesives and fiberglass and polyester separators performed very well. DOE

N83-22830# Boeing Computer Services, Inc., Seattle, Wash
INTERMEDIATE PHOTOVOLTAIC SYSTEM EXPERIMENT OPERATIONAL PERFORMANCE REPORT. VOLUME 3: FOR G. N. WILCOX MEMORIAL HOSPITAL, KAUAI, HAWAII

Sep 1982 30 p refs
(Contract DE-AC04-76DP-00789)
(DE83-000801; SAND-81-7080/3-VOL-3) Avail: NTIS HC A03/MF A01

A photovoltaic power system was used to provide electricity and a heating source for a hospital. Practical experience was gained in using photovoltaic systems for the generation of electricity and heat. Problems associated with the utility power tie-in during any period of excessive or insufficient power generation were assessed. The photovoltaic concentrator system was also assessed. S.L.

N83-22831# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

ADVANCED SILICON-SHEET-GROWTH TECHNIQUES

T. SUREK Jun. 1982 24 p refs Presented at the Am Section of the Intern. Solar Energy Soc. Conf., Houston, Tex., 1 Jun. 1982

(Contract DE-AC02-77CH-00178)
(DE82-017088; SERI/TP-211-1637, CONF-820629-12) Avail: NTIS HC A02/MF A01

The status of silicon sheet growth techniques for photovoltaic applications is critically reviewed. The advanced processes reviewed include web-dendrite growth, edge-defined film-fed growth, edge-supported pulling, edge stabilized ribbon, silicon-on-ceramic, low-angle silicon sheet growth, and the ribbon-to-ribbon process. Comparisons are made of the process stabilities in terms of the thermal and mechanical (i.e., meniscus) control characteristics, and of the resultant controls on the ribbon geometry (i.e., width and thickness). The processes are also compared based on material quality considerations. Recent advances in the technologies and problems which need to be resolved are described. The emphasis of the discussions is on examining the viability of these sheet materials as solar cell substrates for low-cost silicon photovoltaic systems. DOE

N83-22840# National Bureau of Standards, Washington, D.C. Center for Building Technology

OUTDOOR EXPOSURE TESTS OF SOLAR ABSORPTIVE COATINGS

L. W. MASTERS, J. F. SEILER, and W. E. ROBERTS Oct. 1982 24 p refs
(PB83-124560; NBSIR-82-2583) Avail: NTIS HC A02/MF A01 CSCL 10A

The research presented in this report focuses upon the results obtained by continuing the outdoor exposures of absorptive coatings using ASTM E781-81, Standard Practice for Evaluating Absorptive Solar Receiver Materials When Exposed to Conditions Simulating Stagnation in Solar Collectors with Cover Plates. Comparison of the results of the outdoor exposures with those obtained in accelerated laboratory exposures indicated that (1) the accelerated exposures, as described in ASTM E744-80, Standard Practice for Evaluating Solar Absorptive Materials for Thermal Applications, provide more severe exposure conditions than outdoor exposures, and (2) the degradation processes induced by outdoor exposure are adequately addressed by the accelerated laboratory exposures. Author (GRA)

N83-22841# National Bureau of Standards, Washington, D.C. Center for Building Technology

HAIL IMPACT TESTING PROCEDURE FOR SOLAR COLLECTOR COVERS

D. R. JENKINS (Univ. of Central Florida) and R. G. MATHEY Apr. 1982 87 p refs
(PB83-104745; NBSIR-82-2487) Avail: NTIS HC A05/MF A01 CSCL 10B

Laboratory test results which simulate hail impact on solar collector covers are presented. Development of a test method for evaluating the resistance of solar collector covers to this type of loading is discussed. A procedure for such testing is described as well as results obtained with ice balls impacting four typical collector cover materials. Aspects which are discussed include the preparation of ice balls, the design and operation of a launcher for ice ball propulsion, the method of mounting cover panel specimens, the selection of ice ball velocity and impact location, and techniques for failure or damage assessment. GRA

N83-22842# Atlas Corp., Santa Cruz, Calif
DEVELOPMENT OF AN ADVANCED SOLAR AUGMENTED WATER HEATER (FOR SINGLE FAMILY HOME APPLICATIONS) Final Report, Feb. 1980 - May 1982

H. GRUNES, D. MORRISON, and F. DEWINTER Jun. 1982 137 p refs
(PB83-119610, GRI-79/0117) Avail: NTIS HC A07/MF A01 CSCL 13A

A program was undertaken to design, construct and test two advanced prototype solar augmented gas water heaters. Computer analyses and experimental work were used to optimize components and characterize performance. The resulting design includes a solar preheat tank, a gas-fired backup tank, the collector loop pump and all operating controls contained in a single cylindrical package. The backup tank is positioned above the solar preheat tank. The connection between the solar and backup tanks is effectively a thermal diode which restricts heat transfer from the backup to the solar tank but allows the backup tank to become an integral part of solar storage whenever the solar tank temperature surpasses the backup tank set point temperature. Solar heat is supplied through a jacketed tank drainback system. GRA

N83-22843# National Bureau of Standards, Washington, D.C. National Engineering Lab
PERFORMANCE CRITERIA FOR SOLAR HEATING AND COOLING SYSTEMS IN RESIDENTIAL BUILDINGS Final Report

Sep 1982 240 p refs
 (Contract IAA-H54-81)
 (PB83-122663, NBS-BSS-147, LC-82-600581) Avail NTIS HC A11/MF A01 CSCL 13B

This performance criteria, developed for the Department of Housing and Urban Development, is a baseline document for criteria and standards for the design, development, technical evaluation, and procurement of solar heating and cooling systems for residential buildings in accordance with the requirements of Section 8 of Public Law 93-409, the Solar Heating and Cooling Demonstration Act of 1974. The document is intended to establish minimum levels of performance with regard to health and safety and the various aspects of technical performance. The criteria for health and safety put primary emphasis on compliance with existing codes and standards. The criteria on thermal and mechanical performance, durability/reliability and operation/servicing present performance requirements considered to be representative of acceptable levels. GRA

N83-22856# California Univ., Los Angeles Lab of Biomedical and Environmental Sciences

ENVIRONMENTAL EFFECTS OF SOLAR-THERMAL POWER SYSTEMS: ECOLOGICAL OBSERVATIONS DURING EARLY TESTING OF THE BARSTOW 10-MWE PILOT STPS

F. B. TURNER, ed. Nov 1982 54 p refs
 (Contract DE-AC03-76SF-00012)
 (DE83-004454, UCLA-12-1385) Avail. NTIS HC A04/MF A01

Environmental measurements were continued at Solar One during 1982, while final steps in construction and early testing were carried out. Measurements of sand depths downwind (east) of the heliostat field indicated that some of the sand blown off the field (most of it between September 1979 and March 1980) was carried farther east, reducing sand depths somewhat in areas just east of the field. Observations of birds between March and June 1982 revealed that the natural avifauna of the field was altered, although the area is still used for feeding by some icterids (larks, blackbirds) and aerial insectivores (swallows, swifts). Of 15 bird casualties ascribable to the presence and/or operation of Solar One, 12 followed collisions with heliostats, three resulted from incineration in heliostat beams. The central receiver tower does not appear to be a source of mortality. Numbers of rodents (particularly kangaroo rats) trapped in areas downwind of the site declined steadily between 1978 and 1982 in areas both closest to the field and as far east as 600 m from the fence. DOE

N83-26442# Joint Publications Research Service, Arlington, Va.
STUDY OF PSYCHOPHYSIOLOGICAL DISTINCTIONS OF PRIMATES USING DELAYED REACTION TEST

I. P. SHEREMET, G. S. BELKANIYA, and N. F. SOFIKIS. In *its USSR Rept Space Biol and Aerospace Med*, Vol. 17, No. 2, Mar - Apr. 1983 (JPRS-83467) p 133-137. 13 May 1983 refs. Transl. into ENGLISH from Kosmich. Biol i Aviakosmich. Med (Moscow), v 17, no 2, Mar - Apr 1983 p 90-92. Avail NTIS HC A07

The efficacy of teaching and training is largely determined by the characteristics of animals' higher nervous activity (HNA). Such elements of HNA as short-term and long-term memory, which correlate the most with the learning capacity of animals, are particularly important. In view of the need to screen monkeys for teaching them operator work following the program of preparations for an experiment aboard an artificial earth satellite, our aim was to search for and refine an objective psychophysiological test. The method of testing delayed reactions (DR), which is used extensively to assess intercentral relations in the central nervous system, effect of diverse factors on human and animal memory and experimental study of interaction between different forms of memory served as our basis. DR are a complex neuropsychological phenomenon and for this reason most studies deal with the reflex

basis and neurophysiology of DR. Our purpose here was to adapt the method of testing DR to the test requirements, as well as to use the developed DR test to evaluate individual psychophysiological reactivity of monkeys. L.F.M.

03

HYDROGEN

Includes hydrogen production, storage, and distribution.

A83-19837
LAMINAR BURNING VELOCITIES OF HYDROGEN-AIR AND HYDROGEN-AIR-STEAM FLAMES

D. D. S. LIU and R. MACFARLANE (Whiteshell Nuclear Research Establishment, Pinawa, Manitoba, Canada). Combustion and Flame, vol 49, Jan. 1983, p. 59-71. Research supported by the Ontario Hydro and Whiteshell Nuclear Research Establishment. refs

The laminar burning velocities of hydrogen-air and hydrogen-air-steam mixtures were measured as a function of temperature and composition of the unburned gases by means of laser-Doppler anemometry coupled with schlieren photography. A relationship between the burning velocity of the mixtures and the temperature and composition is established. Values obtained for the burning velocities of the mixtures agree with those given by Gunther and Janisch (1972). New data are given for the burning velocities as a function of the temperature of unburned gases. The presence of steam in the mixtures is found to slow down their combustion rates. A correlation equation valid for a concentration range of 18-65% in volume for hydrogen and 0-15% for steam, and for a temperature range of 23-250 C is derived from the observed burning velocities. M.I.I.

A83-20082#
FUEL FOR FUTURE TRANSPORT AIRCRAFT

G. D. BREWER (Lockheed-California Co., Burbank, CA). Mechanical Engineering, vol 105, Jan 1983, p. 50-55.

The advantages of introducing liquid hydrogen (LH2) as aircraft fuel to replace Jet A are described, noting its superiority to other alternatives such as kerosene and liquid methane. Hydrogen can be produced by either electrolytic or thermochemical water splitting, thus making it producible anywhere in the world, a condition which is not offered by the unequal distribution of the global fossil fuels. Hydrogen's low density, low boiling point, and high diffusion velocity in air are factors which make it inherently safer than hydrocarbon fuels, especially in a crash. LH2 combustion and production do not contribute to the global CO2 problem. NASA studies have indicated that LH2 is suitable for aircraft flying routes ranging from 1500-10,600 n mi, with higher performance, i.e., ultimate energy efficiency than conventional fuels or kerosene. An economic analysis for a steam-reformation of coal process to produce LH2, if carried out as part of a cogeneration operation, would yield LH2 fuel costing less than aviation-grade kerosene. A time frame for developing the technologies necessary for the total replacement of hydrocarbon-based fuels with LH2 is outlined. M.S.K.

A83-20586
A MECHANISTIC STUDY OF OXYGEN EVOLUTION ON LI-DOPED CO3O4

P. RASIAH and A. C. C. TSEUNG (City University, London, England). (Electrochemical Society, Meeting, Minneapolis, MN, May 10-15, 1981). Electrochemical Society, Journal, vol 130, Feb. 1983, p. 365-368. Research supported by the Science Research Council of England. refs

Studies of the oxygen evolution on Li-doped Co3O4 (001) and Teflon-bonded Co3O4 (002) electrodes in KOH medium using the steady-state galvanostatic technique are reported. Electrocatalyst preparation and electrode fabrication methods suggested by Tseung and Rasiah (1970) were used to prepare the electrodes.

03 HYDROGEN

Oxygen evolution I-V measurements were made to determine the effects of Ti and KOH concentration, particularly on the 10 a/o (001) electrode. The oxygen evolution performance was measured at 70 C in 5 mol/cu dm KOH on the (001) electrodes and at 25 C in 5 N KOH on the 10 a/o (002) electrode. The results of the studies are discussed and a reaction mechanism is proposed, based on Tafel's analysis and on the reaction order parameters. It is concluded that the oxygen evolution performance increased with an increase in Li doping. Laboratory durability tests carried out on these electrodes under practical conditions showed good stability of structure and performance for 5800 hr. The present study is pertinent to the development of water-electrolysis techniques for hydrogen production. M I I

A83-22083#

THE PHOTOREDUCTION OF WATER - A STUDY OF A MODEL SYSTEM [LA PHOTOREDUCTION DE L'EAU - ETUDE D'UN SYSTEME MODELE]

P KELLER Paris XI, Université, Docteur es Sciences Physiques Thesis, 1981 210 p. In French. refs

Experimental and analytical results from a study of the photochemical reduction of water to produce storable hydrogen fuel are reported. The system considered comprises a chemical based on Ru for absorbing the sunlight, an electron relay (methyl viologen), an electron source (EDTA), and the oxyreduction catalyzer (colloidal platinum). The energetic and chemical steps which lead to hydrogen production once the system is exposed to light are quantified. An optimum pH for operations is determined to be 5, which yields the highest formation rate and efficiencies for hydrogen production. The limiting factor for the catalytic efficiency of the system is the total hydrogenation of the methyl viologen catalyzed by the colloidal platinum. Experimentation to characterize the component behavior in the multistep photoreduction process is described, including the use of a laser as the light source. M S K

A83-23701

PRESENT STATUS OF R&D FOR HYDROGEN PRODUCTION FROM WATER IN JAPAN

K YOSHIDA (Tokyo, University, Tokyo, Japan) International Journal of Energy Research, vol. 7, Jan-Mar 1983, p. 1-12 refs

A83-24357*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va

SYSTEMS AND OPERATIONS - LIVING WITH COMPLEXITY AND GROWTH

W R HOOK (NASA, Langley Research Center, Hampton, VA) Astronautics and Aeronautics, vol. 21, Mar 1983, p. 53-55.

Since the space station concept currently being developed by NASA calls for system updates and additions over a period of at least ten years following launch, attention must be given to the interfaces between station elements. Efforts have begun to develop generic fault detection, isolation, and correction techniques that could simplify on-orbit operations, maintenance and repair. An integrated hydrogen-oxygen system has been identified as the feature promising the greatest reduction in resupply costs. Scavenging excess fuel from the Space Shuttle's internal and external tanks, and using leftover Shuttle payload for fluid tankage, could supply hydrogen and oxygen for consumption in the form of propellants, fuel cell electricity, and life support gases. Advancements in cryogenic fluid management and storage technology are the keys to the design of this integrated system. Attention is given to the Interactive Design and Evaluation of Advanced Spacecraft computer-aided design and analysis system, which allows system engineers to study the integration problems presented by 40 technical modules. O C

A83-24365

JOINT MEASUREMENTS OF RADIAL VELOCITY AND SCALARS IN A TURBULENT DIFFUSION FLAME

S H. STARNER (Sydney, University, Sydney, Australia) Combustion Science and Technology, vol. 30, no. 1-6, 1983, p. 145-169. Research supported by the Australian Research Grants Committee. refs

Simultaneous laser Doppler and Mie scattering measurements are being carried out in a horizontal turbulent hydrogen diffusion flame in a co-flowing stream using aluminum oxide particles to seed the nozzle fluid. Scalar time traces are obtained from the resulting light scattering signal which are then processed together with the record of the radial velocity in order to yield the turbulent fluxes of the main species, temperature, and mixing fraction. The measurement technique is evaluated by experiments utilizing a known isothermal flow. It is found that the profiles and values of the normalized Favre mixture fraction fluxes are close to those of non-reacting jets only after burnout, far downstream, and it appears that a chemical reaction reduces the upstream flow flux. The mixture fraction radial gradient and the corresponding radial fluxes are found to show similar profiles throughout the measured region with no significant instance of counter-gradient flow. The scalar fluxes are significantly modified by radial pressure gradients, probably an augmentation of the mixture fraction flux near the centerline and a suppression in the outer region of the flame. Reasonable agreement with the experimental data is obtained using gradient modelling of the mixture fraction flux for this flame.

N B

A83-24367

LASER FLUORESCENCE MEASUREMENTS OF THE OH CONCENTRATION IN A COMBUSTION BOUNDARY LAYER

R J CATTOLICA (Sandia National Laboratory, Livermore, CA) and R W SCHEFER (California, University, Berkeley, CA) Combustion Science and Technology, vol. 30, no. 1-6, 1983, p. 205-212. Research supported by the U.S. Department of Energy. refs

A laser-induced fluorescence technique was used to measure the OH radical concentration in the boundary layer combustion of a lean hydrogen-air mixture (with a fuel-air equivalence ratio of 0.2) flowing over a heated (1170 K) platinum plate. The highly nonequilibrium OH concentration profile was observed 5 to 50 mm from the leading edge of the plate and to within 0.25 mm of the surface. The maximum OH concentration occurred near the leading edge of the platinum plate and was about 200 times its equilibrium value. (Author)

A83-24667*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va

USING A GLOBAL HYDROGEN-AIR COMBUSTION MODEL IN TURBULENT REACTING FLOW CALCULATIONS

R C. ROGERS (NASA, Langley Research Center, High-Speed Aerodynamics Div., Hampton, VA) and W CHINITZ (Cooper Union for the Advancement of Science and Art, New York, NY) AIAA Journal, vol. 21, Apr 1983, p. 586-592. refs

(Previously cited in issue 06, p. 836, Accession no. A82-17790)

A83-27209

ON-SITE PRODUCTION OF ELECTROLYTIC HYDROGEN FOR GENERATOR COOLING

B R MEHTA (Electric Power Research Institute, Palo Alto, CA) In IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1147-1149. refs

Hydrogen produced by water electrolysis could be cost effective over the merchant hydrogen used for generator cooling. Advanced water electrolyzers are being developed specifically for this utility application. These designs are based on solid-polymer-electrolyte and alkaline water electrolysis technologies. This paper describes the status of electrolyzer development and demonstration projects. (Author)

A83-27210**A VIABLE PROCESS FOR PRODUCING HYDROGEN SYNFUEL USING NUCLEAR FUSION HEAT**

T. R. GALLOWAY (Mittelhauser Corp., Berkeley, CA) and L. C. BROWN (General Atomic Co., San Diego, CA) In IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1150-1159 Research sponsored by the U.S. Department of Energy refs

Analytical and costing analyses of a thermochemical water splitting plant powered by a tandem mirror fusion reactor are presented. Design criteria indicated directing high quality steam to the chemical plant, where no liquid metal coolants would be used. Minimal pumping distances for high pressure He, multiple barriers between the neutron-activated blanket and the hydrogen product, and modular construction where possible are necessary. A He-Brayton topping cycle, coupled to a steam-Rankine bottoming cycle are selected. Slightly over 1111 MWt and about 720 MWe could be produced by the plant if all low grade waste heat is directed to the Rankine cycle. SO₃ is used with water for the splitting process, then recombined H₂ is siphoned off as a fuel and O₂ is delivered to a coal reforming plant. A 30 yr plant life is projected, operating at a 70% thermal efficiency for the splitting process and producing H₂ at \$10-12/GJ. The plant is expected to become economically viable in the year 2030 if debt financing is available at 12.25% per year M.S.K.

A83-27213**A SYSTEMS ANALYSIS COMPARING CONVENTIONAL AND HYDROGEN POWERED RAIL LOCOMOTIVES**

B. A. STEINBERG and D. S. SCOTT (Toronto, University, Toronto, Canada) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1178-1183 refs

A computer model simulating the performance of a diesel-electric locomotive and consist, over any duty cycle, has been formulated. The model allows for the comparison of alternate fuels in the diesel engine mode, and the comparison of different modes of power generation, i.e., diesel electric vs electric vs fuel cell. In combination with an engine fuel consumption model, this systems analysis will compare conventional and hydrogen powered rail locomotives (Author)

A83-27215**IS LH2 THE HIGH COST OPTION FOR AIRCRAFT FUEL**

G. D. BREWER (Lockheed-California Co., Burbank, CA) In IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1191-1196 refs

Applications, costs, and various concepts for production of LH₂ are outlined. NASA studies have shown that if LH₂ is used as aviation fuel the higher cost, as compared to CH₄ or synjet, will be offset by lowered operational costs because of lighter weight and higher heat of combustion. A continuous steam-iron process for converting coal and water to H₂ for aircraft fuels is projected to have a delivered cost of \$8/MBtu, if the plant also generates electricity for sale to the grid. Untapped geothermal and hydroelectric resources are cited as favorable locations to set up electrolysis plants, thus assuring that future fuel cost increases will not affect the plant operating costs. Magnetic refrigeration, i.e., the magnetocaloric effect could yield a 25-40% reduction in the cost of liquefaction. A suggestion is presented to use LH₂ in aircraft to cool an intermediate gas, e.g., N₂, which can be piped through tubes in the surface of the aircraft in cruise conditions to create laminar flow. Charging airline passengers 4 mills/mile travelled would be sufficient to equip all major U.S. airports to handle LH₂ in 5 yr. M.S.K.

A83-27216**CURRENT RESEARCH IN ADVANCED WATER ELECTROLYSIS IN THE UNITED STATES AND ABROAD**

M. BONNER, T. BOTTS, J. MCBREEN, A. MEZZINA, F. SALZANO, and C. YANG (Brookhaven National Laboratory, Upton, NY) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1197-1201 refs

An overview on advanced water electrolysis system for H₂ production is provided. The survey of the work sponsored by the Department of Energy through Brookhaven National Laboratory (BNL) includes: General Electric's scale-up of SPE technology; Teledyne's identification of the best available electrodes and separators for advanced alkaline systems, Life Systems' testing of a novel static water feed concept; and advanced electrolysis research at BNL. Also included is recent progress in Canada, Europe (development of inorganic ion exchange membranes), and Japan (alkaline and SPE plants) which is based on information reported to the International Energy Agency (Author)

A83-27333**MODELING AND EVALUATION OF DESIGNS FOR SOLID HYDROGEN STORAGE BEDS**

P. W. FISHER and J. S. WATSON (Oak Ridge National Laboratory, Oak Ridge, TN) International Journal of Hydrogen Energy, vol 8, no 2, 1983, p. 109-119 refs (Contract W-7405-ENG-26)

A numerical model for a cylindrical geometry hydrogen storage bed is presented. The configuration consists of a cylindrical bed filled with an FeTi alloy, with hydrogen introduced by means of a porous metal tube and heat transferred in and out of the system by a water flow in a shell around the bed. The energy balances are calculated from the heat accumulation, the reaction heat in the hydride sorption bed, and the heat conducted. Boundary conditions are defined, and a computer program flow diagram is provided for the physical properties of the system. Adaptation to other systems is possible with inputs as functions of pressure, temperature, and hydride composition. An equilibrium version of the model which contains no adjustable parameters was compared with previous experimental data. Predictions are made of the pressure drop and the effect of the cooling configurations used. It is found that kinetic effects must be accounted for in the model if good quantitative agreement is to be obtained. M.S.K.

A83-27334**POSSIBILITIES OF IMPROVING EXHAUST EMISSIONS AND ENERGY CONSUMPTION IN MIXED HYDROGEN-GASOLINE OPERATION**

H. MAY (Kaiserlautern, Universitaet, Kaiserlautern, West Germany) and D. GWINNER (Daimler-Benz AG, Stuttgart, West Germany) (Motortechnische Zeitschrift, vol. 42, no 4, 1981.) International Journal of Hydrogen Energy, vol 8, no 2, 1983, p 121-129. Translation refs (Contract DE-AC01-80CS-50093)

The results regarding exhaust gas emissions and efficiency obtained on a 6-cylinder Otto engine operating with a mixture of hydrogen and gasoline are discussed. Furthermore, the control equipment developed for this engine and the corresponding characteristic control curves are described. The results of exhaust gas measurements within the ECE- and CVS-test procedure with a test car, running with a mixture of hydrogen and gasoline, are demonstrated (Author)

A83-27336**CLEAN-UP AND PROCESSING OF COAL-DERIVED GAS FOR HYDROGEN APPLICATIONS**

S. KASPER (Dravo Engineers, Inc., Pittsburgh, PA) International Journal of Hydrogen Energy, vol 8, no 3, 1983, p 183-190 refs

It appears that only a few large-scale industrial applications need to be examined for utilization of coal-derived hydrogen. Applications selected as representative for considerations of

03 HYDROGEN

purification are related to ammonia, methanol, iron ore reduction, fuel cells, and pipeline gas. Purity requirements and raw gas composition are discussed, and a description of purification processes is provided. Attention is given to particulates, tar, ammonia and water, light oils, bulk acid gas removal, trace sulfur removal, carbon monoxide, hydrogen cyanide, cryogenic purification, and molecular sieves. In view of the very high purity requirements for many hydrogen applications, and the variety of undesirable components in the raw coal gas, the purification task may seem to be too formidable. However, the utilization of hydrogen gas for the production of methanol and ammonia in many countries proves that such a purification is economically feasible. G R

A83-27337

THEORY OF THE COMPUTER CODE RET 1 FOR THE CALCULATION OF SPACE-TIME DEPENDENT TEMPERATURE AND COMPOSITION PROPERTIES OF METAL HYDRIDE HYDROGEN STORAGE BEDS

I. A. EL OSERY (Inshas Nuclear Research Centre, Cairo, Egypt) International Journal of Hydrogen Energy, vol. 8, no. 3, 1983, p. 191-198 refs

A83-27338

POROUS METAL HYDRIDE COMPACTS - PREPARATION, PROPERTIES AND USE

E. TUSCHER, P. WEINZIERL (Wien, Universitaet, Vienna, Austria), and O. J. EDER (Osterreichisches Forschungszentrum Seibersdorf GmbH, Vienna, Austria) International Journal of Hydrogen Energy, vol. 8, no. 3, 1983, p. 199-203. Research supported by the Bundesministerium fuer Wissenschaft und Forschung and Burgenlandstiftung Theodor Kery refs

Porous compacts containing CaNi_5 as hydrogen storage material and Al, Cu or Ni as admixed metals were prepared. The influence of composition, compacting pressure and heat treatment on the storage capacity and cycling behavior of the pellets was investigated by hydrogen absorption/desorption measurements. The microstructure of the compacts and the distribution of the metals were determined by optical metallography and scanning electron microscope (SEM). For their application in a chemical compressor, cylindrical storage containers were constructed and tested (sorption rate, transient behavior of the hydrogen pressure). (Author)

A83-27339

MAGNESIUM FOR HYDROGEN STORAGE

A. S. PEDERSEN, J. KJOLLER, B. LARSEN, and B. VIGEHOLM (Riso Forsogsanlaeg, Roskilde, Denmark) International Journal of Hydrogen Energy, vol. 8, no. 3, 1983, p. 205-211 refs

A study of the hydrogenation characteristics of fine magnesium powder during repeated cycling has been performed using a high-pressure microbalance facility. No effect was found from the cycling regarding kinetics and storage capacity. The reaction rate of the absorption process was fast at temperatures around 600 K and above, but the reversed reaction showed somewhat slower kinetics around 600 K. At higher temperatures the opposite was found. The enthalpy and entropy change by the hydrogenation, derived from pressure-concentration isotherms, agree fairly well with those reported earlier. (Author)

A83-27340

A SYSTEM OF HYDROGEN-POWERED VEHICLES WITH LIQUID ORGANIC HYDRIDES

M. TAUBE (Zuerch, Eidgenoessische Technische Hochschule, Wuerenlingen, Switzerland), D. W. T. RIPPIN, D. L. CRESSWELL (Zuerch, Eidgenoessische Technische Hochschule, Zurich, Switzerland), and W. KNECHT (Saurer Adolph, Ltd., Arbon, Switzerland) International Journal of Hydrogen Energy, vol. 8, no. 3, 1983, p. 213-225.

A system for storing and using energy in the form of liquid organic hydride is described. All the technical processes proposed in the system are well established. The dehydrogenation reaction takes place in a catalytic reactor (more than 400°C, approximately 20 bar) in the vehicle. The hydrogenation occurs in a central

plant, servicing approximately 195 vehicles, where the hydrogen is produced by the electrolysis of water (22 MW, electric) and is catalytically reacted with toluene, transforming it into methylcyclohexane. A 17-ton truck having a 150-kW (mechanical) engine and an operating range of approximately 250 km per day for 250 days per year is taken as a reference vehicle. The catalytic reactor in the vehicle for the dehydrogenation has a volume of approximately 50 liters. The tank containing the methylcyclohexane, the carrier of hydrogen, holds about 710 liters. The basis for the cold start is the direct burning of toluene. A breakdown of the costs is included. C R

N83-16493*# Kent State Univ., Ohio Dept. of Physics

APPLICATIONS OF ION BEAM TECHNOLOGY Final Report

E. GELERINTER and N. SPIELBERG Aug 1980 40 p refs (Contract NAS3-21945)

(NASA-CR-169797, NAS 1.26.169797) Avail NTIS HC A03/MF A01 CSCL 11F

Wire adhesion in steel belted radial tires; carbon fibers and composite; cold welding, brazing, and fabrication, hydrogen production, separation, and storage, membrane use, catalysis; sputtering and texture, and ion beam implantation are discussed.

Author

N83-17323# Brookhaven National Lab., Upton, N. Y. Dept. of Nuclear Energy

HYFIRE: A TOKAMAK/HIGH-TEMPERATURE ELECTROLYSIS SYSTEM

J. A. FILLO, J. R. POWELL, R. BENENATI, T. C. VARLJEN, J. W. H. CHI, and J. S. KARBOWSKI 1981 4 p refs. Presented at the 9th Symp. on Eng. Probl. of Fusion Res., Chicago, 26 Oct 1981. Prepared in cooperation with Westinghouse Electric Corp., Pittsburgh, Pa.

(Contract DE-AC02-76CH-00016)

(DE82-004806; BNL-30297, CONF-811040-136) Avail NTIS HC A02/MF A01

The development of a system for using the thermal energy produced in a high-temperature Tokamak blanket to provide the electrical and thermal energy required to drive a high-temperature water electrolysis process is described. Emphasis is on two design points, one consistent with electrolyzer peak inlet temperatures of 1400°C, which is an extrapolation of present experience, and one consistent with a peak electrolyzer temperature of 1100°C. This latter condition is based on laboratory experience with high-temperature solid electrolyte fuel cells. A major conclusion is that the technical integration of fusion and high-temperature electrolysis appears to be feasible and that overall hydrogen production efficiencies of 50 to 55% seem possible. DOE

N83-17633# General Atomic Co., San Diego, Calif

STATUS REPORT ON SULFUR IODINE THERMOCHEMICAL WATER-SPLITTING CYCLE

G. E. BESENBRUCH, L. C. BROWN, M. YOSHIMOTO, J. H. NORMAN, D. R. OKEEFE, M. ENDO, C. L. ALLEN, M. L. KELLY, and P. W. TRESTER Nov. 1981 9 p refs. Presented at the Intern. Colloq. on Use of Nucl. Heat for Process Appl., Aachen, 17 Sep. 1981.

(Contract DE-AC01-80CS-80004, DE-AC02-80ET-26225)

(DE82-007164, GA-A-16610, CONF-8109102-2) Avail NTIS HC A02/MF A01

Major process improvements were investigated and their feasibility demonstrated. The engineering process flowsheet was revised to incorporate this. It is being used for an estimate of hydrogen production cost. An energy storage cycle for a solar adaptation of the sulfur iodine cycle was identified and is being evaluated along with features particularly concerning the availability and level of insolation and how it affects engineering design of the chemical plant. Efforts are also underway to design the sulfur iodine cycle around the Tandem Mirror Fusion Reactor. Potential systems for HI purification are being investigated which could eliminate the need for the phosphoric acid treatment completely and could result in significant savings in capital cost for this part

of the process. Potential catalysts for the liquid HI decomposition step were evaluated
DOE

N83-17668# Oak Ridge National Lab, Tenn
EXPERIMENTAL TECHNIQUES FOR THE STUDY OF PHOTOSYNTHETIC WATER SPLITTING
D A MCWHIRTER, J P EUBANKS, and E GREENBAUM
1981 10 p refs Presented at the Ann Meeting of the Inst. of Chem Engrs, New Orleans, 8-11 Nov. 1981
(Contract W-7405-ENG-26)
(DE82-003974, CONF-811108-8) Avail NTIS HC A02/MF A01

A novel experimental apparatus will be presented which is used for the study of biological solar energy conversion. This method utilizes the photosynthetic splitting of water to produce molecular hydrogen and molecular oxygen. Two oxygen sensors will be described. The first is the Burr-Mauzerall oxygen luminometer. The second sensor is a modified Hersch electrogalvanic cell. The hydrogen sensor is a zirconium oxide high temperature fuel cell. Both sensors are arranged in tandem in a continuous flow stream. Techniques of measuring and calibration will be reported. DOE

N83-17740# Brookhaven National Lab, Upton, N Y Dept of Energy and Environment
SYSTEMS ANALYSIS OF HYDROGEN SUPPLEMENTATION IN NATURAL GAS PIPELINES
A HERMELEE, M BELLER, and J DACIERNO Nov 1981 12 p refs Presented at the 4th Intern Conf on Alternative Energy Sources, Miami, Fla, 14-16 Dec 1981
(Contract DE-AC02-76CH-00016)
(DE82-006933, BNL-30440, CONF-811212-10) Avail: NTIS HC A02/MF A01

The potential for hydrogen supplementation in natural gas pipelines is analyzed for a specific site from both mid-term (1985) and long-term perspectives. The concept of supplementing natural gas with the addition of hydrogen in the existing gas pipeline system serves to provide a transport and storage medium for hydrogen while eliminating the high investment costs associated with constructing separate hydrogen pipelines. This paper examines incentives and barriers to the implementation of this concept. The analysis is performed with the assumption that current developmental programs will achieve a process for cost-effectively separating pure hydrogen from natural gas/hydrogen mixtures to produce a separable and versatile chemical and fuel commodity. A major aspect of the study is to perform a market analysis of traditional uses of resources in the various consuming sectors and the potential for hydrogen substitution in these sectors
DOE

N83-17757# Joint Publications Research Service, Arlington, Va.
WEST EUROPE REPORT: SCIENCE AND TECHNOLOGY, NO. 133
10 Jan 1983 33 p refs Transl into ENGLISH from various West European articles
(JPRS-82608) Avail NTIS HC A03/MF A01

Combined-cycle power plant tests, low quality fuel, chemical coal-conversion, gasification, research financial management, airbus sales and construction, and LPG and hydrogen automobile fuels are discussed.

N83-17758# Joint Publications Research Service, Arlington, Va
LPG, HYDROGEN: AUTOMOBILE FUELS OF TOMORROW DISCUSSED
P HAZAN In its West Europe Rept: Sci. and Technol, No 133 (JPRS-82608) p 13-18 10 Jan 1983 Transl. into ENGLISH from Le Matin (France), 11 Oct 1982 p 18-19
Avail NTIS HC A03/MF A01

In Italy, 450,000 cars are running on liquefied gas. This is now becoming a fashion in France. In the United States, researchers may have succeeded in lowering the cost of hydrogen, which will perhaps be the fuel of the third millennium
Author

N83-19104# Eimco Mining Machinery International, Salt Lake City, Utah.

A CLEAN INTERNAL COMBUSTION ENGINE FOR UNDERGROUND MINING MACHINERY. A TECHNICAL ASSESSMENT AND PROGRAM PLAN, PHASE 1 Final Report, Aug. 1980 - Dec. 1981

N BAKER, L HOUSTON, F LYNCH, L OLAVSON, and G. SANDROCK 31 Dec 1981 232 p refs
(PB82-244724; BM-OFR-86-82) Avail NTIS HC A11/MF A01 CSCL 081

The feasibility of employing hydride fueled internal combustion engines to power mobile underground mining machinery is assessed. Problems are identified and solution and a development plan are proposed with the objective of constructing, testing, and demonstrating a nonpolluting engine suitable for underground use.
GRA

N83-19826*# National Aeronautics and Space Administration, Pasadena Office, Calif

COMBUSTION ENGINE SYSTEM Patent Application

J HOUSEMAN (JPL, California Inst of Tech, Pasadena) and G E VOECKS, inventors (to NASA) (JPL, California Inst of Tech., Pasadena) 16 Aug 1982 35 p
(NASA-CASE-NPO-14565-2, US-PATENT-APPL-SN-408266)
Avail NTIS HC A03/MF A01 CSCL 07D

A flow through catalytic reactor which selectively catalytically decomposes methanol into a soot free hydrogen rich product gas utilizing engine exhaust at temperatures of 200 to 650 C to provide the heat for vaporizing and decomposing the methanol is described. The reactor is combined with either a spark ignited or compression ignited internal combustion engine or a gas turbine to provide a combustion engine system. The system may be fueled entirely by the hydrogen rich gas produced in the methanol decomposition reactor or the system may be operated on mixed fuels for transient power gain and for cold start of the engine system. The reactor includes a decomposition zone formed by a plurality of elongated cylinders which contain a body of vapor permeable, methanol decomposition catalyst preferably a shift catalyst such as copper-zinc
NASA

N83-21183# Mueller Associates, Inc, Baltimore, Md
SAFE HANDLING AND TESTING OF ALTERNATIVE FUELS

Jan 1982 31 p refs
(Contract DE-AC05-79CS-56051)
(DE82-009176, DOE/CS-56051/6) Avail NTIS HC A03/MF A01

Safety hazards involved in the handling and use of conventional and alternative fuels are presented. Recommendations for fire fighting of alcohol and alcohol blend fuels are described. Physical property and toxicological data on conventional and alternative fuels are included. Report is intended for those individuals inexperienced in the handling and use of fuels and as a general reference on fuel safety
DOE

N83-22349# Institute of Gas Technology, Chicago, Ill
STATUS OF THE CADMIUM THERMOELECTROCHEMICAL HYDROGEN CYCLE

T P WHALEY, B D YUDOW, R J REMICK, J B PANGBORN, and A F SAMMELLS 1982 8 p refs Presented at the World Hydrogen Energy Conf, Pasadena, Calif, 13-17 Jun 1982
(DE83-900088, CONF-820605-20) Avail NTIS HC A02/MF A01

The three step cadmium thermoelectrochemical water splitting cycle which produces hydrogen by an electrochemical reaction of water with an anode of cadmium metal, which is regenerated by the thermochemical decomposition of by product cadmium oxide at temperatures of 12000C and higher is discussed. Work on the electrochemical step is centered on the removal of the passivating layer of cadmium hydroxide that forms on the cadmium metal anode. The high temperature thermochemical decomposition of cadmium oxide is carried out successfully in a solar furnace
DOE

N83-22352# Science Applications, Inc., Chatsworth, Calif
Combustion Science and Advanced Technology Dept
STUDY OF NET SOOT FORMATION IN HYDROCARBON REFORMING FOR HYDROGEN FUEL CELLS Final Report
R. B. EDELMAN, R. C. FARMER, and T. S. WANG Aug 1982
43 p refs
(Contract DE-AC21-79MC-12735)
(DE83-001046, DOE/MC-12735/1251) Avail NTIS HC A03/MF A01

A quasi-global kinetics model to represent the homogeneous and heterogeneous reactions which control the autothermal hydrogen reforming process was studied. The accompanying soot formation and gasification was emphasized. DOE

N83-22813# Institute of Gas Technology, Chicago, Ill
HYDROGEN USE IN A RURAL ALASKAN COMMUNITY
T. D. DONAKOWSKI, C. F. BLAZEK, M. NOVIL, and E. J. DANIELS 13 Jun 1982 10 p refs Presented at the World Hydrogen Energy Conf., Pasadena, Calif., 13-17 Jun 1982
(DE83-000568, CONF-820605-21) Avail NTIS HC A02/MF A01

The plan and design of a program which demonstrates an all hydrogen community in rural Alaska are discussed. The prospects of reducing Alaska's dependency on fossil fuels by producing hydrogen from renewable resources and easing the burden of transporting fuel to remote sites are assessed. The hydrogen system considers Alaska's unique resources, supply logistics, demographics, and economics. Integration of hydrogen production with transportation, distribution, storage, and utilization equipment is discussed for a rural village. One aspect of the community's energy use and supply will be converted to an all hydrogen. This includes equipment required for hydrogen production, residential hydrogen utilization, transportation, and electricity generation. The social, legal, and economic issues encountered in planning the demonstration are described. Author

N83-23173# Brookhaven National Lab., Upton, N. Y
HYFIRE: A TOKAMAK/HIGH-TEMPERATURE ELECTROLYSIS SYSTEM
J. A. FILLO, J. R. POWELL, R. BENENATI, T. C. VARLJEN, J. W. H. CHI, and J. S. KARBOWSKI 1982 9 p refs Presented at the World Hydrogen Energy Conf., Pasadena, Calif., 13 Jun 1982
(Contract DE-AC02-76CH-00016)
(DE82-013851, BNL-31072) Avail NTIS HC A02/MF A01

The HYFIRE studies to date have investigated a number of technical approaches for using the thermal energy produced in a high-temperature Tokamak blankets to provide the electrical and thermal energy required to drive a high-temperature (1000 C) water electrolysis process. Current emphasis is on two design points, one consistent with electrolyzer peak inlet temperatures of approximately 1300 C, which is an extrapolation of present experience, and one consistent with a peak electrolyzer temperature of 1100 C. This latter condition is based on current laboratory experience with high-temperature solid electrolyte fuel cells. Our major conclusion to date is that the technical integration of fusion and high-temperature electrolysis appears to be feasible and that overall hydrogen production efficiencies of 50 to 55% seem possible. DOE

FUELS AND OTHER SOURCES OF ENERGY

Includes fossil fuels, nuclear fuels, geothermal and ocean thermal energy, tidal energy, and wind energy

A83-19847#
EFFECT OF MOLECULAR STRUCTURE ON INCIPIENT SOOT FORMATION

H. F. CALCOTE and D. M. MANOS (AeroChem Research Laboratories, Inc., Princeton, NJ) Combustion and Flame, vol. 49, Jan 1983, p. 289-304. refs
(Contract F49620-77-C-0029)

A rational threshold soot index (TSI) varying from 0 to 100 is defined for evaluating the onset of soot formation in both premixed and diffusion flames. It is shown that all of the data in the literature on either premixed or diffusion flames, taken by many techniques, are consistent with respect to molecular structure for each of the two types of flames. There is also a closer similarity between the effect of molecular structure on soot formation in premixed and diffusion flames than previously thought. The use of TSI permits one to use all of the literature data to interpret molecular structure effects and thus arrive at rules for predicting the effect of molecular structure for compounds which have not yet been measured or to correlate the results from the experimental system with another. If a correlation can be demonstrated between the effect of molecular structure on soot formation in laboratory and in practical systems, then TSIs will be useful to the synfuels program for defining the desired fuel components to be prepared from a given feedstock. (Author)

A83-20265*# Hewlett-Packard Co., Cupertino, Calif
CORROSION OF 310 STAINLESS STEEL IN H₂-H₂O-H₂S GAS MIXTURES STUDIES AT CONSTANT TEMPERATURE AND FIXED OXYGEN POTENTIAL

D. B. RAO (Hewlett-Packard Co., Cupertino, CA), K. T. JACOB (Toronto, University, Toronto, Canada), and H. G. NELSON (NASA, Ames Research Center, Materials Science and Applications Office, Moffett Field, CA) Metallurgical Transactions A - Physical Metallurgy and Materials Science, vol. 14A, Feb. 1983, p. 295-305 refs

(Previously announced in STAR as N81-19276)

A83-20436
DEVELOPMENT AND APPLICATION OF ADVANCED DIAGNOSTICS METHODS IN FOSSIL FUEL COMBUSTION STUDIES

D. R. HARDESTY (Sandia National Laboratory, Livermore, CA) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 104-120 refs

A83-21014#
INVESTIGATION OF SLURRY FUEL PERFORMANCE FOR USE IN A RAMJET PROPULSOR

I. PELEG (Raphael Armament Development Authority, Propulsion Dept., Haifa, Israel) and Y. M. TIMNAT (Technion - Israel Institute of Technology, Haifa, Israel) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p. 102-110. refs

A theoretical examination of the use of light-element slurries as fuels in ramjet applications is presented. The heat and density of B, Al, Mg, and C are noted to be higher than the same properties obtainable from hydrocarbon fuels, while materials and mechanical considerations require that the slurries be thin enough to be pumped and injected into the combustion chamber. The settling rate is calculated for particles suspended in kerosene, and it is found that a slurry with thixotropic properties is best suited, since a high viscosity retards the settling of the particles. The thixotropy can

be produced by the introduction of gelling agents into the kerosene fuel while still maintaining a high shear rate. Computer simulations have modeled the specific impulse and flame temperature values for kerosene, kerosene with boron, and kerosene with aluminum slurries with various particle densities by volume. The highest possible additions of B are recommended although, if no volume restrictions or maneuvering constraints are necessary, then kerosene alone has suitable performance M S K

A83-21423

FLAMES WITH IMPINGING JETS

Y GOLDMAN, Y M TIMNAT (Technion - Israel Institute of Technology, Haifa, Israel), and M SHAHAF Israel Journal of Technology, vol 19, no 5-6, 1981, p 188-192 Research supported by the National Council for Research and Development and Kernforschungsanlage Juelich GmbH

A combustor, in which the primary air jet carrying the atomized fuel is separated from the secondary air entrance and the two flows are going in opposite directions, was built and a series of tests were performed with gas-oil, pulverized-coal and coal-oil mixtures. The parameters varied included the fuel injection angle and the inlet location, the variables measured were flow quantities, temperature and combustion product composition. Photographic tests showed that one can distinguish between a small and a big droplet zone, the former clustered close to the centerline, the latter on the outside. The combustion tests show that the most intense burning takes place in a narrow region downstream of the entrance, where high combustion intensity is achieved. It is thus possible to decrease the combustion volume by a factor of three to four. (Author)

A83-21458

HIGH TEMPERATURE EROSION AND EROSION-HOT CORROSION OF SUPERALLOYS AND COATINGS

J C GALSWORTHY, G C BOOTH (Admiralty Marine Technology Establishment, Poole, Dorset, England), and J E RESTALL (National Gas Turbine Establishment, Farnborough, Hants, England) In High temperature alloys for gas turbines 1982, Proceedings of the Conference, Liege, Belgium, October 4-6, 1982 Dordrecht, D Reidel Publishing Co., 1982, p 207-235. refs

High temperature erosion and erosion-hot corrosion in gas turbine engines is outlined by reference to research and operational experience of components in turbine powerplant. Testing techniques have been surveyed and the mechanisms of erosion and erosion-hot corrosion illustrated. Some guidance is given on the requirements for high temperature erosion and erosion-hot corrosion resistance in superalloys and coatings, and methods for the prevention or reduction of this type of damage. Problems anticipated in the future energy scenario are discussed, particularly in relation to coal conversion. (Author)

A83-21945

TECTONIC ELEMENTS REGISTERED ON THE LANDSAT IMAGERY IN AREA OF YUGOSLAVIA AND THEIR PRACTICAL MEANING

M OLUIC (Industrijski projekt, Zagreb, Yugoslavia) and D CVIJANOVIC (Civil Engineering Institute, Zagreb, Yugoslavia) In: International Society for Photogrammetry and Remote Sensing, International Symposium, Toulouse, France, September 13-17, 1982, Transactions Volume 1 Toulouse, Groupement pour le Developpement de la Teledetection Aerospatiale, 1982, p 567-574 refs

A83-21946

MAIN ADVANCES AND NEEDS ON THE STUDY OF GEOTHERMAL RESOURCES IN CHILE BY USING REMOTE SENSING TECHNIQUES

M ARAYA F, M PARDO P (Universidad de Chile, Santiago, Chile), and R PIRACES L (Prominas, Ltda., Santiago, Chile) In International Society for Photogrammetry and Remote Sensing, International Symposium, Toulouse, France, September 13-17, 1982, Transactions Volume 1 Toulouse, Groupement pour le Developpement de la Teledetection Aerospatiale, 1982, p 577-586

Successful preliminary results have been obtained in several pilot experiences related with the study of geothermal in Los Andes Range, Chile by using remote sensing techniques. These results are related with the prospection and explorational stages of a geothermal field. Multispectral and multitemporal satellite and aerial photographs and images have been used for these purposes. Based on these positive results, a general global program will be intended to study geothermal resources along the whole country. This methodology could also be applied to other countries along Los Andes Range. The main aspects of the performed experiences and the future activities related with this global program are included in this paper. (Author)

A83-22324

METHANE SYNTHESIS ON NICKEL BY A SOLID-STATE IONIC METHOD

T M GUR and R A HUGGINS (Stanford University, Stanford, CA) Science, vol. 219, Feb 25, 1983, p 967-969 NSF-supported research refs

The feasibility of electrochemically synthesizing methane by a Fischer-Tropsch type reaction by use of a solid oxide electrolyte has been demonstrated. This solid-state ionic approach provides in situ control of the oxygen activity at the gas-catalyst interface by imposing a suitable voltage drop across an oxygen-conducting solid electrolyte from an external source. Methanation rates for hydrogen-carbon monoxide and hydrogen-carbon dioxide synthesis gas mixtures upon nickel electrodes showed substantial enhancement with the use of this technique, reaching values nearly two orders of magnitude higher than their intrinsic rates. (Author)

A83-22421

CURRENT ASPECTS OF WIND-ENERGY UTILIZATION - STATUS AND PROSPECTS IN BULGARIA [S'VREMENNI ASPEKTI NA PROBLEMA ZA ISPOLZUVANE NA VETROVATA ENERGIJA - S'STOIANIE I PERSPEKTIVI U NAS]

N GODEV and E GEORGIEVA (B'lgarska Akademiia na Naukite, Geofizicheski Institut, Sofia, Bulgaria) B'lgarsko Geofizichno Spisanie, vol 8, no 4, 1982, p 25-33 In Bulgarian refs

Problems arising in the use of wind energy on a significant scale are discussed, and the progress made in this area in Bulgaria is summarized. On the basis of calculations of the wind-energy distribution on Cape Kaliakra in Bulgaria, the wind-energy resources in this region are compared with the findings of Kiuchukova and Ivanov (1975). It is shown that whereas conditions exist in the country for using wind energy on a large scale, the meteorological network does not encompass all the suitable regions. A method of finding places suitable for exploitation is outlined. The method involves both numerical evaluations and observational tests. C R

A83-23191

PREDICTION OF TURBULENT MIXING IN CONFINED CO-AXIAL REACTING JETS

M M M ABOU-ELLAIL and T W ABOU-ARAB (Cairo, University, Cairo, Egypt) In Numerical methods in laminar and turbulent flow, Proceedings of the Second International Conference, Venice, Italy, July 13-16, 1981 Swansea, Wales, Pineridge Press, 1981, p 339-349 refs

A numerical model is presented for simulation of parabolic reacting and nonreacting flows as are present in a coaxial diffusion flame. Solution procedures are defined for the continuum equations

04 FUELS AND OTHER SOURCES OF ENERGY

of the conservation of mass, momentum, and energy, with account taken of turbulence and reaction kinetics. The continuum equations are discretized and finite difference equations are solved iteratively after linearization. Predictions are generated for the case of a coaxial diffusion flame in a circular duct, and good agreement is demonstrated with experimental data. D H.K.

A83-23748 PREMIXED, TURBULENT COMBUSTION OF A SUDDEN-EXPANSION FLOW

Y. EL BANHAWY (Ain Shams University, Cairo, Egypt), S. SIVASEGARAM (Peradeniya, University, Peradeniya, Sri Lanka), and J. H. WHITELAW (Imperial College of Science and Technology, London, England) Combustion and Flame, vol 50, Mar 1983, p 153-165. Research supported by the Science Research Council refs

Measurements of mean values of velocity, temperature and concentrations of carbon monoxide, carbon dioxide, unburned hydrocarbon, and oxygen have been obtained in the two-dimensional flows downstream of two backward facing steps which stabilized premixed methane-air flames of equivalence ratios 0.77, 0.90 and 0.95. The maximum mean temperature increased from 1710 to 2000K with equivalence ratio, and the maximum intensity of the temperature fluctuations, like those of velocity fluctuations, was close to coincident with inflections in the mean profiles. The intensity of the temperature fluctuations achieved values in excess of unity and, at the locations of maximum mean temperature, in excess of 0.5. The larger step gave rise to a wider reaction region and to a slightly different trajectory. An increase in the flow rate of cooling water and, therefore, a decrease of wall temperature resulted in increased concentrations of unburned hydrocarbon and carbon monoxide in the near-wall region. Discrete frequency fluctuations occurred at the natural frequency of the flow chamber: the magnitude of the energy of these fluctuations was small. (Author)

A83-23877# RADIATION AND SMOKE FROM THE GAS TURBINE COMBUSTOR USING HEAVY FUELS

Y S H NAJJAR (Yarmouk University, Irbid, Jordan) and E M. GOODGER (Cranfield Institute of Technology, Cranfield, Beds, England) ASME, Transactions, Journal of Heat Transfer, vol 105, Feb. 1983, p. 82-88 refs

Broadening of aviation fuel specifications has been simulated using blends of gas oil and residual fuel oil. Radiation, smoke, and temperature measurements in an experimental combustor at various air pressure, inlet temperature, and air/fuel ratios showed a diminishing rate of increase of radiation with soot concentration and reduced sensitivity of smoke to fuel hydrogen content at higher combustor pressures. (Author)

A83-24035# DEGRADATION AND CHARACTERIZATION OF ANTIMISTING KEROSENE

R J. MANNHEIMER (Southwest Research Institute, San Antonio, TX) Journal of Aircraft, vol 20, Apr. 1983, p 350-358 U.S. Department of Transportation refs
(Contract DOT-FA79WA-4310)

(Previously cited in issue 19, p 3326, Accession no. A81-40867)

A83-24551# NNE-SSW FAULT SYSTEM IN PART OF THE GULF OF SUEZ AND ITS BEARING ON OIL EXPLORATION

M. M. KHATTAB (United Arab Emirates University, Al Ain, United Arab Emirates) In Remote sensing of arid and semi-arid lands, Proceedings of the International Symposium on Remote Sensing of Environment, Cairo, Egypt, January 19-25, 1982. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1982, p. 321-336. refs

Aeromagnetic maps and gravity profiles of the Gulf of Suez are discussed to determine the geologic structure of the basement which produces the NNE trending gravity associated with the

magnetic highs observed. Historical data indicates the area is characterized by three elongated, NW-SE striking fault blocks. The gravity highs observed are designated the Ras Dib gravity high because its axis is coincident with the meridional line passing by Ras Dib on the bank of the Gulf. The magnetic high features a 9 gamma/km gradient, and the observed gravity is calculated to have a 3 km depth at center of a horizontal sheet 4.2 km thick. The magnetic profile has a center, width, and thickness of 3.1 km below sea level, 7.5 km, and 1.2 km, respectively. A tectonic analysis of the region indicates pre-upper Cretaceous age of the Ras Dib fault block, with a current interaction among a pre-Tertiary fault block, early-Tertiary faulting, and Alpine and/or Erythrean faulting. The results are significant for oil exploration in the southern part of the Gulf of Suez. M.S.K.

A83-24561# GEOLOGY AND STRUCTURES STUDY OF THE NUBA MOUNTAINS, SUDAN, USING LANDSAT IMAGES

A S ANDRAWIS (South Dakota State University, Brookings, SD) In Remote sensing of arid and semi-arid lands, Proceedings of the International Symposium on Remote Sensing of Environment, Cairo, Egypt, January 19-25, 1982. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1982, p. 465-472.

A83-24577# USE OF REMOTE SENSING TECHNIQUES TO STUDY GEOTHERMAL RESOURCES IN ARID AND SEMI-ARID ZONES IN CHILE

M. ARAYA F. (Universidad de Chile, Santiago, Chile) and R. PIRACES L. (Comite Geotermico, Santiago, Chile) In Remote sensing of arid and semi-arid lands, Proceedings of the International Symposium on Remote Sensing of Environment, Cairo, Egypt, January 19-25, 1982. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1982, p. 617-634 refs

A83-24626# STRUCTURAL GEOMORPHOLOGY OF RAJASTHAN BASIN, INDIA-INTERPRETED THROUGH LANDSAT IMAGERY AND AERIAL PHOTOS

P. V. L. P. BABU (Oil and Natural Gas Commission, Dehra Dun, India) In Remote sensing of arid and semi-arid lands, Proceedings of the International Symposium on Remote Sensing of Environment, Cairo, Egypt, January 19-25, 1982. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1982, p. 1177-1184.

Geomorphic landforms of structural, fluvial, aeolian and aeolian-denudational origin have been identified in the Rajasthan desert, India, based on the analysis of Landsat imagery and aerial photos. The dune forms are largely related to the shape of the underlying ground. It has been found that obstacle dunes are associated with buried ridges, longitudinal and linear dunes with flat topped hills and table land, transverse dunes with hill slopes and anomalous zones and parabolic dunes with low lying areas. The regional structure under the desert is similar to that of the cuesta landscape exposed along the margin of the basin. A few structural anomalies on the desert surface may prove to be reflecting subsurface structures which are probable places for oil accumulation. (Author)

A83-25247 HYDROGEOLOGIC STUDIES ABROAD [GIDROGEOLOGICHESKIE ISSLEDOVANIYA ZA RUBEZHOM]

N. A. MARINOV, (ED.) Moscow, Izdatel'stvo Nedra, 1982. 428 p. In Russian.

The current status of hydrogeologic studies in countries other than the Soviet Union is examined, with attention given to the problems of regional hydrogeology, the dynamics and preservation of groundwaters, and artificial groundwater recharge. Other topics discussed include melioration and mining hydrogeology, the use of thermal and mineral waters, the use of isotopes, and deep-well disposal of waste waters. The discussion also covers the use of advanced experimental techniques (such as remote sensing) in hydrogeology. V.L.

A83-25268*# Drexel Univ, Philadelphia, Pa. DROPLET SIZE EFFECTS ON NO_x/ FORMATION IN A ONE-DIMENSIONAL MONODISPERSE SPRAY COMBUSTION SYSTEM

H SARV, A. A. NIZAMI, and N. P. CERNANSKY (Drexel University, Philadelphia, PA) American Society of Mechanical Engineers, Joint Power Generation Conference, Denver, CO, Oct 17-21, 1982, 9 p refs
(Contract NAG3-1)
(ASME PAPER 82-JPGC-GT-10)

A one-dimensional monodisperse aerosol spray combustion facility is described and experimental results of post flame NO/NO_x emissions are presented. Four different hydrocarbon fuels were studied: isopropanol, methanol, n-heptane, and n-octane. The results indicate an optimum droplet size in the range of 48-58 microns for minimizing NO/NO_x production for all of the test fuels. This NO_x behavior is associated with droplet interactions and the transition from diffusive type of spray burning to that of a prevaporized and premixed case. Decreasing the droplet size results in a trend of increasing droplet interactions, which suppresses temperatures and reduces NO_x. This trend continues until prevaporization effects begin to dominate and the system tends towards the premixed limit. The occurrence of the minimum NO_x point at different droplet diameters for the different fuels appears to be governed by the extent of prevaporization of the fuel in the spray, and is consistent with theoretical calculations based on each fuel's physical properties (Author)

A83-25271*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

CATALYTIC COMBUSTION WITH STEAM INJECTION

D. N. ANDERSON and R. R. TACINA (NASA, Lewis Research Center, Cleveland, OH) American Society of Mechanical Engineers, Joint Power Generation Conference, Denver, CO, Oct. 17-21, 1982, 9 p refs
(ASME PAPER 82-JPGC-GT-23)
(Previously announced in STAR as N83-15805)

A83-25619 REMOTE-SENSING STUDIES OF OIL-AND-GAS-BEARING TERRITORIES IN THE CASPIAN BASIN [AEROKOSMICHESKIE ISSLEDOVANIYA NEFTEGAZONOSNYKH TERRITORII PRIKASPIISKOI VPADINY]

D. S. ORUDZHEVA, V. T. VOROB'EV, and A. A. ROMASHOV (Moscow, Izdatel'stvo Nauka, 1982, 92 p. In Russian. refs)

The work examines methods for the remote-sensing study of oil-and-gas-bearing areas on three levels: regional surveys, the products of which are special maps of 1:2,500,000 scale, regional studies involving an assessment of the feasibility of searching for oil-and-gas-bearing structures, and detailed studies involving recommendations directed toward the search for oil-and-gas-bearing structures. Particular attention is given to the search for oil-and-gas-bearing areas in the southeastern part of the Caspian Basin and in the Aral-Caspian region. B. J.

A83-25691# SPRAY COMBUSTION PROCESSES - A REVIEW

N. CHIGIER (Carnegie-Mellon University, Pittsburgh, PA) American Society of Mechanical Engineers, Winter Annual Meeting, Phoenix, AZ, Nov 14-19, 1982, ASME, 11 p refs
(ASME PAPER 82-WA/HT-86)

The basic processes and instrumentation for analyzing combustion in liquid fuel sprays are reviewed. The application of group combustion analytical techniques to model fuel sprays through the stages of atomization, vaporization, and combustion is examined. Attention is given to the models developed by Chiu et al (1977, 1978, and 1981), particularly for calculations for spray flames and critical group combustion numbers. Spray analyses are required to provide still and motion picture images, drop size distributions, drop number density, drop velocities, liquid and air distributions, vaporization rates, and temperature and species concentration distributions. Imaging is accomplished with microscopy, photography, television, and holography. Details of

drop sizing interferometric and Fraunhofer diffraction particle analysis methods are reviewed, and the necessity of studying diesel fuel combustion is emphasized. M. S. K.

A83-26198 SHOCK INITIATED IGNITION IN HEPTANE-OXYGEN-ARGON MIXTURES

A. BURCAT (Technion - Israel Institute of Technology, Haifa, Israel), R. F. FARMER, and R. A. MATULA (Louisiana State University, Baton Rouge, LA) In Shock tubes and waves, Proceedings of the Thirteenth International Symposium, Niagara Falls, NY, July 6-9, 1981. Albany, NY, State University of New York Press, 1982, p. 826-833. refs

The ignition of heptane in mixtures containing oxygen and argon behind reflected shock waves in single-pulse shock tubes of having inside diameters of 56 mm and 26 mm is investigated. The measurements encompass the temperature range 1100-1700 K, with the reflected shock pressures varying from 2 to 12 atmospheres. Experimental results are obtained for 140 shocks, with ignition delay times measured at the end plate in the large shock tube. A relation is given for correcting these results. In the shock tube of 26 mm, the detection point is found approximately 80 mm from the end plate, and the induction times are correlated by different parameters. These parameters are found to be influenced by gasdynamic effects caused by the combustion process. This behavior is discussed in the context of earlier results. C. R.

A83-26199 A STUDY ON THE HYDROGEN-OXYGEN DIFFUSION FLAME IN HIGH SPEED FLOW

S. TAKAHASHI, Y. YOSHIZAWA, T. MINEGISHI (Ministry of International Trade and Industry, Mechanical Engineering Laboratory, Tokyo Institute of Technology, Tokyo, Japan), and H. KAWADA. In Shock tubes and waves, Proceedings of the Thirteenth International Symposium, Niagara Falls, NY, July 6-9, 1981. Albany, NY, State University of New York Press, 1982, p. 843-850. refs

A shock tube/detonation tube combination is used for the study of hydrogen-oxygen diffusion flames in high speed flows, where the flow behind the incident shock wave that propagates into an O₂-Ar mixture, and the burned gas behind the detonation wave, which travels into a fuel-rich H₂-O₂-Ar mixture, were used to produce the fuel and oxidizer flows, respectively. Diffusion flame formation was investigated by both schlieren and interferometric photography, and the ignition distances of the diffusion flames in a quasi-steady state were measured by direct photographic methods. The detonation tube is shown by the results to provide a useful high speed, high temperature flow, and it is confirmed that the ignition distance is significantly affected by both velocity difference and hydrogen concentration. O. C.

A83-26200 EXPERIMENTAL INVESTIGATION OF SHOCK INITIATED METHANE-COMBUSTION NEAR A WALL

R. KEIPER and J. H. SPURK (Darmstadt, Technische Hochschule, Darmstadt, West Germany) In Shock tubes and waves, Proceedings of the Thirteenth International Symposium, Niagara Falls, NY, July 6-9, 1981. Albany, NY, State University of New York, 1982, p. 851-859. refs

A 633-nm focused laser beam is used in conjunction with a Mach-Zehnder interferometer, to observe boundary layer time-dependent density (index of refraction), in the case of a methane-air mixture in an Ar heat bath that is ignited by a shock reflected from the end wall of a shock tube. Methane absorption is measured by means of a focused He-Ne laser beam at 3.391 microns, and endwall surface temperature is determined by thin film gages. Methane absorption outside the boundary layer is found to be in good agreement with computations based on isobaric combustion, and boundary layer measurements are keeping with predicted trends despite their insufficient space resolution. O. C.

04 FUELS AND OTHER SOURCES OF ENERGY

A83-26805

RESULTS OF THE INVESTIGATION OF THE OIL AND GAS DEPOSITS OF TADZHIKISTAN ON THE BASIS OF SPACE PHOTOGRAPHS [REZUL'TATY IZUCHENIYA NEFTEGAZONOSNOSTI TADZHIKISTANA S ISPOL'ZOVANIEM SNIMKOV, POLUCHENNYKH IZ KOSMOSA]

M. KH. ISHANOV, V. P. LOZIEV, I. U. N. PILGUL, and V. M. NOVIKOV (Gosudarstvennyi Nauchno-Issledovatel'skii i Proizvodstvennyi Tsentr Priroda, USSR) Issledovanie Zemli iz Kosmosa, Jan.-Feb. 1983, p. 38-43. In Russian. refs

A83-26920

THE PROPERTIES OF FUEL FRACTIONS OBTAINED BY THE HYDROGENATION OF LITHIUM-ACHINSK COAL [SVOISTVA TOPLIVNYKH FRAKTSII, POLUCHENNYKH GIDROGENIZATSIEI KANSKO-ACHINSKOGO UGLIA]

E. D. RADCHENKO, D. F. KASATKIN, B. A. ENGLIN, and E. V. NEPOMNIASHCHAYA (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Neftianoi Promyshlennosti, Moscow, USSR) Khimiia i Tekhnologiya Topliv i Masel, no. 3, 1983, p. 4-6. In Russian. refs

The results of a study of the gasoline, kerosene, and diesel oil fractions obtained by the hydrogenation of coal are presented, and the possibility of using these fractions as standard motor fuels is examined. An analysis of the properties of these fractions and a comparison with the effective standards on fuels show that most of these products require additional catalytic processing to achieve more complete hydrogenation of aromatic hydrocarbons and sulfurous and nitrogenous compounds. For this purpose, new types of catalysts and new processes which would yield high-quality fuels have to be developed. V.L.

A83-26921

THE EFFECT OF THE MELT HEAT TREATMENT TIME ON THE PROPERTIES OF LITHIUM LUBRICANTS WITH ADDITIVES [VLIANIE DLITEL'NOSTI TERMOOBRABOTKI RASPLAVA NA SVOISTVA LITIEVYKH SMAZOK S PRISADKAMI]

I. EL-SHABAN, I. G. FUKS, E. M. UVAROVA, S. V. IAROSHEVICH, and M. SAFI (Moskovskii Institut Neftokhimicheskoi i Gazovoi Promyshlennosti, Moscow, USSR) Khimiia i Tekhnologiya Topliv i Masel, no. 3, 1983, p. 14, 15. In Russian.

Lithium lubricants were prepared by thickening petroleum oils LiSt or 12-LiOSt. The mixture (10% soap) was heated to 210 C and held at this temperature for periods from 0 to 60 min; after that, the melt was cooled at 1-2 C/min. Various additives were added to the lubricant to improve its properties. It is shown that holding the molten mixture at 210 C leads to the oxidation of the dispersion medium and accumulation of significant amounts of oxygen-containing surface-active compounds, resulting in a general deterioration of the lubricant properties. This effect becomes more pronounced with holding time and is minimum in lubricants treated for 15 min. V.L.

A83-28632#

INTERPOLATION AND TRANSFORMATIONS OF MAPS [INTERPOLATION ET TRANSFORMATIONS DE CARTES]

J.-L. MARI (Paris VI, Universite, Docteur-Ingenieur Thesis, 1982 186 p. In French refs

Analytical models are presented for treatment and transformations of gravimetric and magnetic maps for geophysical research. Remote sensing of a specific site usually yields gravimetric and magnetic field values which are defined by potentials that are solutions to the Laplace equation. Analysis of the obtained fields permits identification of the underlying geological structures. Spatial and temporal homogenization of the data are two treatment steps, and account for readings taken at different times and in different conditions, as well as compensating for latitude mismatches, relief, atmospheric effects, etc. which affect spaceborne remote sensing data. Data filtering is then accomplished using either data expansions, vertical derivations or integrations, or reductions with reference to polar orientation for the magnetic data. The qualitative aspect of each transformation is examined. M.S.K.

N83-16353# Federal Aviation Administration, Atlantic City, N.J. Technical Center.

EVALUATION OF WIND-DRIVEN RETROREFLECTIVE TAXIWAY EDGE MARKERS Final Report, Apr. - Aug. 1982

G. S. BROWN Dec. 1982 17 p

(Contract FAA PROJ. 081-502-580)

(DOT/FAA/RD-82/80; DOT/FAA-CT-82/131) Avail: NTIS HC 02/MF A01.

An innovative taxiway edge retroreflective marker, designed to rotate when there is sufficient wind, was evaluated to determine whether the markers would provide adequate visual guidance at night while rotating and when stationary, and whether innovative rotating feature adds to or detracts from the guidance value. The markers consist of a plastic can or cylinder, 6 1/4 inches by 8 inches tall, mounted on plastic polyvinyl chloride pipe. Wind collector vanes on the cylinder are used to rotate the cylinder when winds are above approximately 8 knots. Light is reflected at night from retroreflective bands of yellow and blue material and from glass beads imbedded in the painted material. The retroreflective bands of material are staggered vertically producing motion or movement both when rotating horizontally and vertically. The test results concluded that the wind driven edge markers adequately define the taxiway and provided adequate visual guidance for taxiing while the markers were stationary and when rotating during daylight hours and at night. S.L.

N83-16411# Electricity Council, London (England)

THE KINETICS AND MECHANISM OF THE REACTION OF OZONE WITH SULPHIDES

S. D. RAZUMOVSKII, E. I. SHATOKHINA, A. D. MALIEVSKII, and G. E. ZAIKOV Nov. 1982 9 p refs. Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Khim. (USSR), v. 24, 1975 p. 543-546.

(BLL-OA-TRANS-1934-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.

Reactions of ozone with organic compounds of sulphur have been examined mainly with respect to practical applications: in the desulphurization of petroleum and the products of refining of petroleum, in the production of various sulphones and sulphoxides, and in the examination of the composition of sulphur vulcanizers of rubber. The mechanism of the resultant chemiluminescence was studied. The kinetics and mechanism of the interaction of ozone with a number of sulphides and disulphides are reported. E.A.K.

N83-16417*# California Univ., Berkeley Dept. of Chemical Engineering.

ANTI-MISTING ADDITIVES FOR JET FUELS Final Technical Report, 1 Jan. - 30 Sep. 1982

E. A. GRENS, II and M. C. WILLIAMS 1982 10 p refs

(Contract NCC2-164)

(NASA-CR-169751; NAS 1.26:169751) Avail: NTIS HC A02/MF A01 CSCL 21B

The ignition characteristics of sprays, created by wind shear action, of Jet-A fuel containing polyisobutylene additives were examined over ranges of air velocities from 45 to 90 m/s and of fuel/air mass ratios of 0.20 to 8.0. Ignition was by calibrated sparks of energies up to about 0.5 J and by a butane/oxygen flame at 165 J/s. The polymeric additives studied included the grades L80, L160, and L200 from Exxon Chemical and B200 and B230 from BASF. The ignition suppression ability of the additives, as well as their observed anti-misting (AM) behavior, ranked exactly as their molecular weights (viscosity average, $M_{sub v}$) with 400-500 ppm of L80 ($M_{sub v} = 0.68 \times 1,000,000$) being required to suppress ignition of a spray at 51 m/s, 1.8 fuel/air mass ratio, by a 0.55 J spark while only 10 ppm of B230 ($M_{sub v} = 7.37 \times 1,000,000$) was required for the same conditions. The additive concentrations (L160) required for ignition suppression increased with increasing air velocity and with increasing fuel/air ratio. Author

04 FUELS AND OTHER SOURCES OF ENERGY

N83-16427# California Univ., Santa Barbara Dept. of Chemical and Nuclear Engineering

MASS TRANSFER AND CHEMICAL REACTION OF GASEOUS SPECIES IN NON-CATALYTIC AND CATALYTIC POROUS MEDIA SUPPORTING CATALYTIC AND NON-CATALYTIC LIQUIDS

R G. RINKER 1981 7 p refs

(Contract DE-AT03-76ER-70234)

(DE82-021713, DOE/ER-70234/T1) Avail. NTIS HC A02/MF A01

The behavior of supported liquid phase catalysts (SLPC) was investigated both experimentally and theoretically by studying the transport of mass accompanied by homogeneously catalyzed chemical reaction in SLPC under transient as well as steady flow conditions. The kinetics and mechanistic behavior of selected homogeneous catalysts consisting of soluble transition metal complexes were also examined. Efforts to formulate a general model (backed by experiments) for the overall effective diffusivity which includes the contribution of the gas and liquid phases as well as surface diffusion and shows the effects of liquid loading, liquid properties, relative gas solubilities, and pore size distributions in the support media are reported as well as mathematical formulations for extracting SLPC parameters from transient response information resulting from step and/or impulse changes in gaseous feed composition to multiphase flow systems containing dry porous media or liquid pools. DOE

N83-16429# Department of Energy, Pittsburgh, Pa TEST REPORT ON THE COMBUSTION OF PERC AND LBL WOOD OILS Final Report

J M EKMANN and R. B. SNEDDEN Jan 1982 62 p

(DE82-004485, DOE/PETC-TR-82/3) Avail. NTIS HC A04/MF A01

A series of small scale combustion tests were performed on two separate samples of biomass derived oils. They represented a fuel analogous to a petroleum based residual oil and a distillate product of the crude. The tests were conducted in a twenty horsepower, firetube boiler used to study liquid synthetic fuel combustion. The system was instrumented and the test conditions were selected in such a manner that the boiler performance data and pollutant emissions could be compared to a series of tests, in this unit, when No. 2 and No. 6 fuel oil were burned. In general, both biomass derived fuels could be burned successfully, achieving levels of boiler performance similar to those obtained when burning petroleum based fuel oils. Emissions of NO/sub x and SO₂ were in line with the low nitrogen and sulfur content of the fuels and comparable to the data for No. 2 fuel oil. Although operating problems were encountered due to the flow properties of both fuels and a lack of homogeneity in the heavier biomass fuel, these could be overcome by proper design of the fuel handling system. DOE

N83-16439# Burns and Roe Industrial Services Corp., Paramus, N J

CRITIQUE OF CONCEPTUAL DESIGN FOR REMOVAL OF SODIUM FROM LIGNITE BY ION EXCHANGE Final Report

12 Feb. 1982 112 p

(Contract DE-AC18-81FC-10291)

(DE82-010789, DOE/FC-10291/T1) Avail. NTIS HC A06/MF A01

In general, it appears that the proposed process is technically feasible and can be translated into an operating plant that could perform reliably and without unusual operation difficulties. However, the proposed equipment selection would, we believe, be a severe maintenance burden and somewhat difficult to control. We refer specifically to the countercurrent ion exchange contractors and the coal distribution to the 20 required units. These major difficulties may be overcome by selection of a countercurrent decantation (CCD) or similar system, as proposed. Our cost estimates indicate that a CCD system would substantially reduce the capital cost for this section of the plant. Nevertheless, our capital cost estimate for the entire plant is approximately double that in the base case GFETC/UND report. Applying this increased capital cost to the

UND estimate of annual operating expenses, the fixed charges would more than double, from \$0.56/ton to \$1.36/ton of feed lignite. DOE

N83-16444# Massachusetts Inst of Tech., Cambridge Energy Lab.

DESIGN STRATEGY FOR THE COMBUSTION OF COAL-DERIVED LIQUID FUELS

J M. BEER, M. T. JACQUES, W F. FARMAYAN, and J D. TEARE Aug. 1982 175 p refs Sponsored by Electric Power Research Inst.

(Contract EPRI PROJ. 1412-6)

(DE82-905496; EPRI-AP-2517) Avail. NTIS HC A08/MF A01

The amenability of SRC-2 coal derived liquid fuels to combustion process modification by air staging for NO/sub x/ and particulates emission control was investigated. Two experimental systems were used. (1) a laboratory laminar flow reactor for determining rates of evolution of fuel bound nitrogen from pyrolyzing arrays of 150 (SIGMA)m SRC-2 fuel droplets, and (2) a pilot plant scale furnace for determining the effects of combustion air staging, air preheat, quality of atomization and fuel type in the conversion of fuel nitrogen to NO/sub x/. It is shown that there is a significant potential for controlling NO/sub x/ and particulates emissions in coal derived liquid fuel flames by combustion modifications; NO/sub x/ emission levels were reduced from 550 ppm measured in fast mixing single stage flames to less than 100 ppm under optimized staged combustion conditions with particulates emission levels below 0.33 x 10⁽⁺²⁾ lb010(6) Btu. The overall excess air is maintained at approximately 10%. DOE

N83-16445# Avco-Everett Research Lab., Mass. VOLATILE PRODUCTION DURING PREIGNITION COAL HEATING Quarterly Progress Report, Oct. 1981 - Dec. 1981

Jan 1982 13 p

(Contract DE-AC22-80PC-30291)

(DE82-011241, DOE/PC-30291/5) Avail. NTIS HC A02/MF A01

The relationship between volatile matter production from pulverized coal and flame stabilization in a boiler environment is defined. The behavior of pulverized coal under preignition heating conditions is determined and correlated with a detailed kinetic transport model. Design and fabrication of the experimental apparatus is complete. The entire flow, optics and diagnostic systems were installed in the test cell and are operational. DOE

N83-16446# Pennsylvania Univ., Philadelphia Dept. of Chemistry

INSTRUMENTAL METHODS OF ANALYSIS OF SULFUR COMPOUNDS IN SYN-FUEL PROCESS STREAMS Quarterly Technical Progress Report, Oct. - Dec. 1981

J JORDAN, J STAHL, and J YAKUPKOVIC Jan. 1982 24 p refs

(Contract DE-FG22-81PC-40783)

(DE82-011559, DOE/PC-40783/T5) Avail. NTIS HC A02/MF A01

The reaction between thiosulfate and p-hydroxymercuribenzoate was investigated because it can interfere with the determination of HS(-) and the polysulfides by thermometric titration. The literature on the chemistry of the moieties S₂O₄(2-), S₂O₆(2-), S₃O₆(2-), S₅O₆(2-), S₆O₆(2-) is reviewed critically as the basis for analytical methods development. The various moieties exhibit salient differences in behavior related to sulfur chain length. Properties affected include precipitation, cleavage, and electron transfer reactivities, which may have analytical significance. DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-16459# Imhausen-Chemie G m b H, Lahr (West Germany).
OPTIMIZING THE COMBINATION OF A FISCHER-TROPSCH SYNTHESIS WITH COAL HYDROGENATION FOR THE PRODUCTION OF MOTOR FUELS

K H IMHAUSEN, N HEGER, K H EISENLOHR, F. SCHNUR, F. STRATZ, A. VINKE, H GAENSSLEN, H. TEGGERS, U. LENZ, and D KIRCHHOFF Aug. 1982 34 p Transl into ENGLISH of the mono "Optimierung der Kombination einer Fischer-Tropsch-Synthese mit einer Kohlehydrierung zum Zwecke der Produktion von Motorkraftstoffen" West Germany, 26 Jul 1982 Sponsored in part by Bundesministerium fuer Forschung und Technologie (PB82-255167, BMFT-FB-T-80-048) Avail NTIS HC A03/MF A01 CSCL 07A

The most favorable combination of coal hydrogenation, synthesis gas production and Fischer-Tropsch synthesis for the production of (spark ignition and diesel) motor fuels and liquefied gas from lignite and from bituminous coal with or without the simultaneous production of mains gas is discussed. It was found that, for lignite, high pressure hydrogenation had the lowest capital cost of all the processes investigated, yielded motor fuels conforming to specifications and had a high thermal efficiency. For bituminous coal only a combination of high pressure hydrogenation and Fischer-Tropsch synthesis led to specification products. In both cases a combined production of motor fuels, liquefied gas and mains gas could be economically attractive if a market for mains gas exists or can be developed and if the net financial return for the mains gas covers the production costs.

GRA

N83-16460# North Carolina State Univ, Raleigh Dept. of Chemical Engineering.

RATES AND EQUILIBRIA OF DEVOLATILIZATION AND TRACE ELEMENT EVOLUTION IN COAL PYROLYSIS Final Report, Sep. 1977 - Jun. 1981

R M FELDER, C C KAU, J. K FERRELL, and S GANESAN Apr. 1982 103 p refs (Contract EPA-CR-804811) (PB82-260944, EPA-600/7-82-027) Avail NTIS HC A06/MF A01 CSCL 07D

A laminar flow furnace was used to study the kinetics of devolatilization and evolution of S, As, Pb, and Hg in the pyrolysis of pulverized coal in nitrogen. Variables included pyrolysis time, reactor temperature, and coal type. Devolatilization rates and weight losses of the two subbituminous coals tested were lower than those of a bituminous coal. The four elements were released in significant quantities during rapid pyrolysis, with the elemental loss from the bituminous coal proceeding more rapidly and to a greater extent than that from the subbituminous coals. Emissions of As and Pb in subbituminous coal and Pb in bituminous coal were found to be proportional to the total volatile matter released. Emissions of Hg and As in bituminous coal were proportionately greater than the total volatile matter released.

GRA

N83-16461# Little (Arthur D.), Inc., Cambridge, Mass
IGNITION SOURCES OF LNG VAPOR CLOUDS Final Report, Aug. 1980 - Nov. 1981

D J JEFFREYS, N. A MOUSSA, R N CARON, and D S ALLAN Jan 1982 132 p refs Sponsored by GRI (PB82-262577, GRI-80/0108, REPT-85279) Avail NTIS HC A07/MF A01 CSCL 13B

A data base was developed for ignition sources of LNG vapor clouds in urban areas. A literature survey and field surveys of an urban area and of an LNG plant were conducted. Over 150 potential ignition sources were identified. The main source characteristics affecting ignition were analyzed, covering source density, accessibility to a vapor cloud, probability of activation during cloud exposure and ignition potential. Ignition tests were conducted on cigarettes, car lighters, automotive electrical systems and traffic light relays in a 7% methane/air mixture. Methodologies were developed to translate the results of test and analyses into quantitative ignition probabilities. Sample probability values were estimated for selected sources.

GRA

N83-16525*# National Aeronautics and Space Administration, Washington, D. C.

ASSOCIATION-SOLVATION CHARACTERISTIC OF FUELS AND LUBRICATING AND HYDRAULIC OILS

W. SZACHNOWSKI and B. WISLICKI Sep 1982 26 p refs Transl into ENGLISH from Inst Lotnictwa (Prace), no 69-70, 1977 p 125-141. Previously announced in IAA as A78-26758. Transl by Scientific Translation Service, Santa Barbara, Calif. (Contract NASW-3542) (NASA-TM-76957, NAS 1.15:76957) Avail: NTIS HC A03/MF A01 CSCL 07D

For abstract see A78-26758

N83-16543*# California Univ, Berkeley Dept of Chemical Engineering

VISCOMETRIC AND MISTING PROPERTIES OF POLYMER-MODIFIED FUEL Final Technical Report, 1 Nov. 1981 - 30 Sep. 1982

E A. GRENS, II and M C WILLIAMS 1982 9 p refs (Contract NCC2-163) (NASA-CR-169750; NAS 1.26:169750) Avail NTIS HC A02/MF A01 CSCL 21D

Solutions of polyisobutylenes L160, L200, B200, and B230 in Jet-A were prepared at concentrations up to 3000 ppm. These polymers have molecular weights in the range 5 to 9 x 1,00,000 and have previously been shown to induce anti-misting properties in Jet-A. In connection with the pumpability of such solutions, especially at low temperatures, the shear viscosity, eta, of these solutions was measured at temperatures 25 C, 0 C, and -25 C. Concentration-dependence of eta was very similar for all four polymer solutes, the increase of eta(c) at 3000 ppm being roughly four-fold (relative to Jet-A) for the L-series and five-fold for the B-series. This behavior prevailed at all temperatures, and there was no evidence of phase separation or other chemical instability at -25 C at any concentration. In the more practical c-range for anti-misting applications, say within 1000 ppm, the increase of eta(c) was only twofold.

Author

N83-16549# United Technologies Corp, East Hartford, Conn
CHEMICAL EFFECTS IN VAPORIZING SYNTHETIC FUELS Quarterly Report, 23 Jun. - 31 Oct. 1981

A VRANOS and D. S LISCINSKY Oct 1981 25 p refs (Contract DE-AC22-81PC-40278) (DE82-003352; DOE/PC-40278/T1, R81-535720-1Q, QR-1) Avail NTIS HC A02/MF A01

The objectives of this first quarter effort were to investigate the decomposition of SRC-II middle distillate under surface vaporizing conditions and to develop suitable analytical methods for the characterization of SRC-II fuel and vaporized fuel samples. Glass capillary gas chromatography provided a rapid and accurate method of fuel analysis and is the preferred method for analyzing fuel samples. High performance liquid chromatography is expected to be most useful in the analysis of labile or high molecular weight reaction products. Surface vaporization studies were conducted as a function of temperature, residence time and carrier gas oxygen concentration. The dominant variable was temperature, and the most extensive decomposition occurred at the lowest temperature and heating rate studied. The extent of change of individual fuel components was primarily a function of volatility with some dependence on chemical functionality. It is concluded that, for the conditions studied, most of the chemical change occurs within the liquid phase, and this is primarily a liquid phase residence time effect.

DOE

N83-16550# Department of Energy, Bartlesville, Okla.

TRENDS IN MOTOR GASOLINES, 1942 - 1981

E M SHELTON, M L WHISMAN, and P W WOODWARD Jun 1982 31 p refs (DE82-021124, DOE/BETC/RI-82/4) Avail: NTIS HC A03/MF A01

Trends in motor gasolines were evaluated based upon data contained in surveys. These surveys describe the properties of motor gasolines from throughout the country. Various companies

04 FUELS AND OTHER SOURCES OF ENERGY

obtain samples from retail outlets, analyze the samples by the American Society for Testing and Materials (ASTM) procedures, and report the data for compilation, tabulation, calculation, analysis and publication. A typical motor gasoline report covers 2400 samples from service stations throughout the country representing some 48 companies that manufacture and supply gasoline. The reports include trend charts, octane plots, and tables of test results from about a dozen different tests. From these data, a summary report was assembled that shows trends in motor gasolines. Trends of physical properties including octane numbers, antiknock ratings, distillation temperatures, Reid vapor pressure, sulfur and lead content are tabulated, plotted and discussed. Trend effects of technological advances and the interactions of engine design, societal and political events and prices upon motor gasoline evolution are included. DOE

N83-16553# Institute of Gas Technology, Chicago, Ill.
COAL GASIFICATION FOR STATIONARY GAS-TURBINE APPLICATIONS

A GOYAL, D K. FLEMING, and W G BAIR 1981 25 p refs
 Presented at the ASTM Symp. on Alternative Fuels and Refue Fuels Specifications for Stationary Gas Turbine Appl., Phoenix, Ariz., 9-10 Dec 1981

(DE82-902135; CONF-811220-1) Avail: NTIS HC A02/MF A01

Various types of coal gasification processes which are available commercially or are in the developmental stages are reviewed. The properties of the gaseous fuels produced by different gasifiers are discussed. Gas clean-up systems, adaptable for turbine applications, are presented, and factors influencing process selection are outlined. DOE

N83-16558# Oak Ridge National Lab., Tenn
DYNAMIC MODELING AND CONTROL ANALYSIS OF FROTH FLOTATION AND CLEAN-COAL FILTRATION AS APPLIED TO COAL BENEFICIATION

G S CANRIGHT, C H. BROWN, JR., G. O. ALLGOOD, and W R. HAMEL Nov 1981 114 p refs
 (Contract W-7405-ENG-26)

(DE82-004555, ORNL/TM-8015) Avail: NTIS HC A06/MF A01

Dynamic models were developed for coal beneficiation plant froth flotation and vacuum disk filtration processes to perform comparative analyses of manual and automatic control techniques and to determine if implementation of automatic control would be cost effective. The froth cell simulator was based on a tank-in-series model utilizing first-order flotation kinetics. The vacuum disk filter model was based on classical representations of tank mixing, filtration, and drying. Both models were implemented on the Continuous Systems Modeling Program on the IBM-360 computer system. Three types of control were implemented on the froth flotation simulator: a manual operator control, fixed reagent flow-rate control, and automatic feedforward control. Results indicate a definite economic incentive for implementation of automatic control in these flotation units. Calculated payout times for a physical system range from 5 months to 2 years, depending on the frequency of the disturbance and the cost of coal. DOE

N83-16559# Parsons (Ralph M.) Co., Pasadena, Calif
PROCESS ENGINEERING AND MECHANICAL DESIGN REPORTS. VOLUME 1: PRELIMINARY DESIGN AND ASSESSMENT OF A 50,000 BPD COAL-TO-METHANOL-TO-GASOLINE PLANT

Washington DOE Aug. 1982 378 p Prepared in cooperation with W R Grace and Co., Memphis, Tenn 5 Vol

(Contract DE-FC02-80ET-14759)

(DE83-000848, DOE/ET-14759/T1-VOL-1) Avail: NTIS HC A17/MF A01

The process engineering and mechanical design of a 50,000 bpd coal to methanol to gasoline plant is discussed. The plant is designed to produce 50,000 bpd of high octane, unleaded gasoline utilizing approximately 25,300 tpd (exclusive of steam generation which requires 2400 tpd of coal) of high sulfur agglomerating coal having characteristics comparable to that found in the West Kentucky No 9 seam. In addition to the primary production of

gasoline, significant by products include liquefied petroleum gas (LPG), elemental sulfur, anhydrous ammonia, and isobutane. The facility is sited on land located in the vicinity of Baskett, Kentucky, in Henderson County and allows for direct utilization of extensive environmental baseline data and geotechnical data developed. The plant site consists of approximately 3170 acres of moderately hilly terrain with a barge slip designed on the Green River for receipt of raw materials and the shipment of products and by products. DOE

N83-16560# Southern California Edison Co., Rosemead
 Research and Development Div
INVESTIGATION OF METHANOL AS A BOILER FUEL FOR ELECTRIC-POWER GENERATION Final Report

A. WEIR, JR., W H VONKLEINSMID, E A DANKO, and N. J. KERTAMUS Aug 1982 208 p refs

(Contract EPRI PROJ 1412-11)

(DE82-905495; EPRI-AP-2554) Avail: NTIS HC A10/MF A01

A series of combustion tests were made with methanol in a 44.5 MW power boiler to evaluate gaseous emissions and boiler performance. Parallel combustion tests with fuel oil and natural gas provided a basis for comparing the results. Approximately 406,000 gallons of methanol were burned in Boiler 4 of Southern California Edison's Highgrove Generating Station, located in Grand Terrace, California, from February 17 to May 15, 1981. Methanol proved to be an acceptable fuel in terms of its handling and firing characteristics. The slightly higher heat rate and limited derating were judged to be minor disadvantages in the use of methanol. In fact, the derating with methanol was unique with the balanced draft boiler as tested. A striking reduction in the NO/sub x/ emissions of nearly 60% was observed compared to fuel oil and natural gas. The addition of water to methanol caused an additional reduction of NO/sub x/. At present, the use of methanol is not practical in the utility industry. Reliable quantities of methanol, at prices competitive with the costs of conventional fuel, are not currently available. DOE

N83-16561# Engineering Societies Library, New York.

ADVANCED COAL PREPARATION Final Technical Report

1981 32 p Presented at the Advanced Coal Preparation Conf., Henniker, N.H., 2-7 Aug 1981

(Contract DE-FG22-81PC-42294)

(DE82-010502; DOE/PC-42294/T1; CONF-8108116) Avail: NTIS HC A03/MF A01

The 1981 Advanced Coal Processing Engineering Conference evaluated the current state of the art of commercial coal preparation practice and new results. It emphasized a strong practical flavor that scrutinized commercial practice and ferreted out those aspects of various unit operations that presented problems of either a technical or economic nature. Emphasis was placed on the design of advanced coal preparation circuits and new technology needs. New developments and needs in the conventional coal cleaning processes such as heavy media, cycloning, tabling, and flotation were addressed. New approaches in comminution, sizing, dewatering, and tailings disposal were also discussed. Because of the environmental and energy problems, a revolution is taking place in the physical beneficiation of coal technology, spurred by necessity and advancing on the developments of engineering science. DOE

N83-16562# Southwest Research Inst., San Antonio, Tex
NONSTANDARD AGING TESTS ON COAL-DERIVED DISTILLATE FUELS Technical Progress Report, 7 Jul. 1981 - 6 Jan. 1982

J N BOWDEN 6 Feb 1982 9 p

(Contract DE-AC22-81PC-10442)

(DE82-010442, DOE/PC-41755/7) Avail: NTIS HC A02/MF A01

The purpose was to evaluate the stability of coal derived liquid fuels and to provide samples of aged synfuels and deposits formed during aging for detailed characterization. An H-coal derived naphtha and a middle distillate were obtained for testing. A 50/50 blend of solvent refined coal 2 (SRC-2) and a petroleum based

04 FUELS AND OTHER SOURCES OF ENERGY

naphtha was supplied for the storage test. The four week aging data for H-coal naphtha and middle distillate in air and in nitrogen are presented along with their properties in tables. The aging procedure is still underway for the 50/50 blend of SRC-2 naphtha and petroleum based naphtha
DOE

N83-16563# California Univ, Livermore Lawrence Livermore Lab
COAL AS AN OPTION FOR POWER GENERATION IN US TERRITORIES OF THE PACIFIC

I Y. BORG 30 Nov 1981 28 p refs

(Contract W-7405-ENG-48)

(DE82-009462; UCRL-53236) Avail NTIS HC A03/MF A01

A survey of general considerations relating to the use of coal in US territories and trust territories of the Pacific suggests that coal is a viable option for power generation. Future coal supplies, principally from Australia and the west coast of America, promise to be more than adequate, but large bulk carriers will probably not be able to land coal directly because of inadequate port facilities. Hence, smaller than Panamax-class vessels (60,000 dwt) or some arrangement utilizing self-loading barges or lighters would have to be used. Except for Guam, with peak power requirements on the order of 175 MW sub e, most territories have current, albeit inadequate, installations of 1 to 25 MW sub e. Turnkey, conventional coal-fired, electric-power generating systems are available in that size range. US environmental laws are now applicable to Guam and American Samoa; the trust territories are exempt.
DOE

N83-16564# Transamerica Delaval, Inc., Oakland, Calif Engine and Compressor Div.

EMULSIFIED FUEL TESTING IN A MEDIUM SPEED DIESEL ENGINE Final Report, Feb. 1981 - Apr. 1982

J J. BARICH, T L HINRICHS, and K R PEARCE Washington Maritime Administration Jun 1982 137 p

(Contract MA-80-SAC-01059)

(PB82-250697, MA-RD-920-82069, REPT-019-028) Avail NTIS HC A07/MF A01 CSCL 21D

Medium speed diesel engine testing of fuel water emulsification with various grades of diesel fuel was conducted in order to determine the effect of water emulsification on engine performance. Emulsions from 0 to 12% water (by volume) were test run with various water particle sizes, injection timings, and engine loads with four separate fuels. Marine diesel, 1500 SR1, 3500 SR1, and 5000 SR1. Experimental results are presented for the basic engine performance areas for the various conditions run, focusing mainly on the effects of water emulsification on fuel consumption, exhaust emissions, and engine component wear rates. Details of the emulsification system are also discussed.
GRA

N83-16565# Texas A&M Univ, College Station
THERMODYNAMIC PROPERTIES FOR NATURAL GAS BINARIES Final Report, 1 Dec. 1980 - 31 Dec. 1981

K R. HALL and J. C. HOLSTE Jan 1982 19 p Sponsored in part by Gas Research Inst

(PB82-254616) Avail NTIS HC A02/MF A01 CSCL 21D

The report describes experimental measurements of dew and bubble points for a CO₂-C₂H₆ mixture and for CO₂ containing small amounts of methane and/or nitrogen. The apparatus is a Burnett isochoric PVT device. Experimental technique improvements allow accurate determination of the phase boundaries.
GRA

N83-16572# Oak Ridge National Lab, Tenn Chemical Technology Div

SASOL: THE COMMERCIAL EXPERIENCE. AN EXECUTIVE SUMMARY

F M OHARA, JR. Feb 1982 8 p

(Contract W-7405-ENG-26)

(DE82-011304, ORNL/TM-8163) Avail NTIS HC A02/MF A01

The design and operation of Sasol, the South African Fischer-Tropsch coal liquefaction operation is described. Sasol produces gasoline, fuel gas, asphalt, industrial chemicals, fertilizers,

and waxes. The product slate is changed to match market demands by altering the plants; operating conditions
DOE

N83-16753# Research Inst of National Defence, Linköping (Sweden)

LASER DEPTH SOUNDING FOR LOCATING OIL BELOW WATER SURFACE: A PRELIMINARY SURVEY [DJUPSONDERANDE LASER FOER LOKALISIERING AV OLJA UNDER VETTENYTAN - EN FOERSTUDIE]

O STEINVALL, S SVENSSON, and A WIDEN Aug 1982 29

p refs In SWEDISH

(FOA-C-30290-E1) Avail: NTIS HC A03/MF A01

A method which uses laser reflectance to locate oil slicks below the sea surface was developed. Oil can be detected down to 10 to 15 attenuation lengths (10 to 30 m in Baltic Sea water) if the turbidity is continuous and located mostly in the cross section of the laser beam. When the oil is in small disseminated volumes, its total cross section must exceed 10% of the laser beam cross section.
Author (ESA)

N83-16834# Florida Inst. of Tech, Melbourne Space Technology Program

ADVANCED THERMAL-SENSOR-SYSTEM DEVELOPMENT VIA SHUTTLE SORTIE MISSIONS

J A ANGELO, JR and I W GINSBERG (Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.) 1981 31 p refs Presented at the 4th Intern. Conf on Alternative Energy Sources, Miami Beach, Fla, 14 Dec 1981

(Contract DE-AC08-76NV-01183)

(DE82-004932, EGG-1183-1785, CONF-811212-4) Avail NTIS HC A03/MF A01

The use of the space shuttle in various sortie mission modes to evaluate advanced thermal sensor system concepts, prior to a design commitment for automated spacecraft application, is described. Selected terrestrial energy sources of civilian and/or military interest are examined with respect to: (1) thermal source location and characterization and (2) temperature and emissivity measurements. Of particular interest is the application of on orbit sensor testing to demonstrate the location and characterization of potential geothermal energy resources. The role of the payload specialist in thermal source location, sensor operation and real time evaluation of mission performance is discussed.
DOE

N83-16835# Pacific Northwest Lab, Richland, Wash
ISOLATION OF METALLIC COMPLEXES IN SHALE OIL AND SHALE OIL RETORT WATERS

K B OLSEN, A P TOSTE, and D J. HAYES 1981 15 p refs Presented at DOE/NBS Workshop on Environ Speciation and Monitoring Needs, Gaithersburg, Md., 18-20 May 1981

(Contract DE-AC06-76RL-01830)

(DE82-005931, PNL-SA-9394, CONF-810588-6) Avail NTIS HC A02/MF A01

Methods applied to the fractionation of trace metals in shale oil by silica gel and alumina chromatography and the fractionation of retort waters by C18 partition chromatography are described. Direct current plasma emission spectroscopy was used to analyze Fe, Ni, Cu and Mo in the oils and B, Zn, Mo, Fe and Mn in the waters (INAA) was determined. Arsenic in the oils. Instrumental neutron activation analysis. In the silica gel separation most of the metals eluted in two fractions corresponding to the moderately polar and highly polar fractions of the oil. Nickel eluted in the slightly polar fraction of the oils. Further separation of the nickel enriched fraction on alumina yielded a fraction rich in nickel-porphyrin type compounds. Following C18 Sep-pak fractionation of the retort waters, boron and manganese remained associated with the aqueous, or hydrophilic, fraction. Portions of the zinc, molybdenum and iron partitioned in the hydrophobic organic fraction of the retort waters.
GRA

N83-16837# California Univ, Livermore Lawrence Livermore Lab

OIL SHALE PROJECT RUN SUMMARY SMALL RETORT RUN S-7

F J. ACKERMAN, W A SANDHOLTZ, W. C. MILLER, and A B. CASAMAJOR 11 Dec. 1981 50 p refs

(Contract W-7405-ENG-48)

(DE82-004731; UCID-19275) Avail NTIS HC A03/MF A01

Retort Run S-7 was a combustion run in the small retort conducted on October 10-11, 1975 Nitrogen was used to dilute the inlet air to 7.5% oxygen Gas analysis shows that oil was not burned, but the oil yield was only 78% If the oil yield was actually 90% and 1.3 kg of oil was lost up the stack, the mass balance would show a small improvement, 1.2 kg (approx 0.5%) unaccounted for, the energy balance would have only 1% energy unaccounted for, and the carbon balance would be improved from 10.5% to 1.4% loss (DLC) DOE

N83-16838# Bendix Field Engineering Corp, Grand Junction, Colo.

SURVEY OF LANDS HELD FOR URANIUM EXPLORATION, DEVELOPMENT AND PRODUCTION IN FOURTEEN WESTERN STATES FOR THE SIX-MONTH PERIOD ENDING JUNE 30, 1981

Nov. 1981 23 p

(Contract DE-AC13-76GJ-01664)

(DE82-006228; GJBX-413-81) Avail: NTIS HC A02/MF A01

Land ownership statistics relative to uranium exploration in fourteen western states are given in tabular form The statistics set forth for the period covered are based on data gathered from records available to the public The county records of mining claim locations, reports of state and Federal land offices, and commercial reporting services furnished the data DOE

N83-16839# Intercomp Resources Development and Engineering Corp, Denver, Colo.

RESERVOIR ENGINEERING TRANSIENT PRESSURE WELL TESTING, AND PETROPHYSICAL ANALYSES OF WESTERN GAS SANDS Annual Report, Jul. 1978 - Aug. 1979

H C. BIXEL, J. H. KENNEDY, and J E MCELHINEY Bartlesville, Okla DOE Nov 1981 171 p refs

(Contract DE-AC19-79BC-10106; ET-78-C-08-1557)

(DE82-004879, DOE/BC-10106-26) Avail NTIS HC A08/MF A01

Improvement in gas deliverability by massive hydraulic fracturing of low permeability Western Gas Sands has been generally disappointing This investigation uses petrophysical studies, transient pressure analysis of well performance, and parametric study of various fracture properties to aid in the understanding of the results of several DOE cost-shared MHF treatments Both the transient pressure analysis and the parametric study utilize numerical simulation techniques A generalized approach to pressure buildup analyses of tests with short flow periods is developed The parametric analyses are focused on those variable of MHF treatments over which the operator and engineer have some control Improvements in pressure measurement techniques are suggested as well as reasons why MHF treatments have had limited success. DOE

N83-16841# California Univ, Berkeley Dept of Chemical Engineering.

LINEAR OIL DISPLACEMENT BY THE EMULSION ENTRAPMENT PROCESS M.S. Thesis

D P SCHMIDT Berkeley, Calif California Univ, Lawrence Berkeley Lab. Jan. 1982 166 p refs

(Contract W-7405-ENG-48)

(DE82-007751; LBL-13905) Avail NTIS HC A08/MF A01

Lack of mobility control is one of the major impediments to successful enhanced oil recovery, especially for high viscosity oils This work presents experimental and theoretical results for linear secondary oil displacements using dilute, stable suspensions of oil drops. The major hypothesis is that emulsions provide mobility control through entrapment or local permeability reduction, not

through viscosity ratio improvement In order to describe the displacement process, previous emulsion filtration theory is extended to longer cores and to two-phase flow Quantitative agreement between theory and experiment is satisfactory for continuous secondary oil displacement with various drop-size emulsions in unconsolidated sand packs of permeabilities ranging from 0.7 sq micrometers to 3.3 sq micrometers Linear emulsion floods are shown to be most effective when the mean drop-size to pore-size ratio is in the region between straining and interception at the emulsion shock Floods are more effective when the emulsion concentration is high which minimizes retention lag. DOE

N83-16844# Bendix Field Engineering Corp, Grand Junction, Colo.

URANIUM HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE OF THE ST. MICHAEL NTMS QUADRANGLE, ALASKA

L C. HARDY, comp., R F DANDREA, JR, comp., R J. ZINKL, comp, D L. SHETTEL, JR, comp, S L LANGFELDT, comp, S. R. GARCIA, D HANKS, W E GEORGE, and S L BOLIVAR Jan 1982 41 p refs Prepared in cooperation with Los Alamos National Lab

(Contract DE-AC13-76G-01664)

(DE82-009999, GJBX-20-82) Avail: NTIS HC A03/MF A01

Results of a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the St Michael NTMS Quadrangle, Alaska are presented Presented are location data, field analyses, and laboratory analyses of several different sample media. The analytical results for each medium are summarized The data are into groups of stream sediment and lake sediment samples For each group which contains a sufficient number of observations, statistical tables, tables of raw data, and 1:1,000,000 scale maps of pertinent elements and maps showing results of multivariate statistical analyses are included GRA

N83-16865# Pacific Northwest Lab, Richland, Wash.

USER MANUAL FOR GEOCITY: A COMPUTER MODEL FOR COST ANALYSIS OF GEOTHERMAL DISTRICT-HEATING-AND-COOLING SYSTEMS. VOLUME 1: MAIN TEXT

H. D. HUBER, L L FASSBENDER, and C H BLOOMSTER Sep 1982 223 p refs 2 Vol

(DE82-022512, PNL-4422-VOL-1) Avail NTIS HC A10/MF A01

The cost of residential space heating, space cooling, and sanitary water heating or process heating (cooling) using geothermal energy from a hydrothermal reservoir was calculated The GEOCITY simulates the complete geothermal heating and cooling system, which consists of two principal parts: the reservoir and fluid transmission system and the distribution system Geothermal space heating is provided by circulating hot water through radiators, convectors, and fan-coil units Geothermal process heating is provided by directly using the hot water or by circulating it through a process heat exchanger The life cycle cost of thermal energy from the reservoir and fluid transmission system to the distribution system and the life cycle cost of heat (chill) to the end users are calculated by discounted cash flow analysis. DOE

N83-16866# Pacific Northwest Lab, Richland, Wash

USER MANUAL FOR GEOCITY: A COMPUTER MODEL FOR COST ANALYSIS OF GEOTHERMAL DISTRICT-HEATING-AND-COOLING SYSTEMS. VOLUME 2: APPENDICES

H D HUBER, L L FASSBENDER, and C H BLOOMSTER Sep 1982 186 p refs 2 Vol

(Contract DE-AC06-76RL-01830)

(DE82-022511, PNL-4422-VOL-2) Avail NTIS HC A09/MF A01

A model to calculate the costs of residential space heating, space cooling, and sanitary water heating or process heating (cooling) using geothermal energy from a hydrothermal reservoir is discussed The model can calculate geothermal heating and cooling costs for residential developments, a multi-district city, or a point demand such as an industrial factor or commercial building

04 FUELS AND OTHER SOURCES OF ENERGY

All the appendices, including cost equations and models for the reservoir and fluid transmission system and the distribution system, descriptions of predefined residential district types for the distribution system, key equations for the cooling degree hour methodology, and a listing of the sample case output are included. The indices for the input parameters and subroutines defined in the user manual are given. DOE

N83-16874# Geological Survey, Norman, Okla.
GEOTHERMAL RESOURCE ASSESSMENT IN OKLAHOMA
M L PRATER, P K. CHEUNG, K V. LUZA, and W E HARRISON Oct. 1981 45 p refs
(Contract DE-AS07-80ID-12172)
(DE82-021288; DOE/ID-12172/T1) Avail. NTIS HC A03/MF A01

In September 1980, the Oklahoma Geological Survey began a program to assess the geothermal potential of the state. The program, thus far, consists of: the preparation of a detailed geothermal-gradient map of Oklahoma at a scale of 1:500,000; and site-specific investigations of gradient and subsurface conditions in areas that appear to have geothermal potential. Two areas where recent mapping showed the high gradients (2.10F/100 feet) were selected for detailed study. These areas are in Haskell and Pittsburgh Counties. Volume was estimated as was deliverability of formation water potentially available from several sandstone units for geothermal applications. The Spiro and Cromwell sands were chosen for the Pittsburgh anomaly. DOE

N83-16887# Pacific Northwest Lab, Richland, Wash
COLLECTION, TRANSPORTATION, AND STORAGE OF BIOMASS RESIDUES IN THE PACIFIC NORTHWEST
L K INABA and D. E EAKIN Nov 1981 56 p refs
(Contract DE-AC06-76RL-01830)
(DE82-004737, PNL-4114) Avail. NTIS HC A04/MF A01

Potential methods for the collection, transportation and storage of agricultural and forest residues in the Pacific Northwest are discussed. Information was gathered from available literature and through contacts with researchers, equipment manufacturers, and other individuals involved in forest and agricultural activities. This information was evaluated, combined, and adapted for situations existing in the Pacific Northwest. A number of methods for collection, transportation, and storage of biomass residues using currently available technology are described. Many of these methods can be applied to residue fuel materials along with their current uses in the forest and agricultural industries. DOE

N83-16893# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho

MUNICIPAL-SOLID-WASTE BICONVERSION TECHNOLOGIES
S A LEEPER, J H WOLFRAM, M. L. CHOW, and L J DAWLEY Oct 1982 74 p refs
(Contract DE-AC07-76ID-01570)
(DE83-000263, EGG-2193) Avail. NTIS HC A04/MF A01

The bioconversion approach in which municipal solid waste (MSW) is a resource from which methane, ethanol, and chemicals can be produced by anaerobic digestion and fermentation is discussed. The quantity and volume of MSW requiring disposal are reduced and stabilized. The relevant literature was surveyed and is reviewed. The availability, composition, and properties of MSW are reported. Pretreatment of lignocellulosic material, the predominant compound of MSW, is described and discussed, including mechanical chemical, and physical processes. DOE

N83-16905# Pacific Northwest Lab, Richland, Wash.
BENCH SCALE RESEARCH IN BIOMASS DIRECT LIQUEFACTION

D C. ELLIOTT 1981 23 p refs Presented at the 13th Biomass Thermochem Conversion Contractors' Meeting, Washington, 27 Oct 1981
(Contract DE-AC06-76RL-01830)
(DE82-005228; PNL-SA-9983; CONF-8110115-3) Avail. NTIS HC A02/MF A01

The progress of process research and product analysis effort on biomass direct liquefaction is analyzed. The results during the past six months are described, including analysis of the final product. Additional product analyses are vapor pressure and heat of vaporization data, product stability, pour point and gas chromatography - and liquid chromatography - mass spectrometry results. Additional studies were made on the utilization of phenolics through methylation, hydrotreating, and butylation as well as direct usage as gasoline extenders. Separation of phenolics from the product as well as the question of corrosivity are addressed. The impact of this study on the biomass direct liquefaction program is related and the implications for other liquefaction techniques are discussed. DOE

N83-16906# Sandia Labs., Albuquerque, N. Mex.
OPERATIONAL EXPERIENCES OF A DOWNHOLE STEAM GENERATOR

B W MARSHALL 1982 17 p refs Presented at the California Regional SPE Meeting, San Francisco, 24 Mar. 1982
(Contract DE-AC04-76DP-00789)
(DE82-010161, SAND-82-0394C, CONF-820316-1) Avail. NTIS HC A02/MF A01

The US Department of Energy supported the development of downhole steam generators for enhanced oil recovery as a part of Project DEEP STEAM. A final step in the development program was to deploy a downhole steam generator in the field to demonstrate its reliable operation and to evaluate the effect of the combined steam/exhaust products effluent on the reservoir. Sandia National Laboratories entered into an agreement with the City of Long Beach to place two direct contact, high pressure combustors in the Wilmington Field in Long Beach, California. These units one downhole and the other on the surface, have now been operated for a few months and gas communication with the production wells measured. The operational experience of this field experiment are discussed. DOE

N83-16907# California Univ., Riverside Inst of Geophysics and Planetary Physics

OXYGEN ISOTOPE EXCHANGE IN ROCKS AND MINERALS FROM THE CERRO PRIETO GEOTHERMAL SYSTEM: INDICATORS OF TEMPERATURE DISTRIBUTION AND FLUID FLOW

A E WILLIAMS and W A. ELDERS 1981 8 p refs Presented at the 3rd Symp on the Cerro Prieto Geothermal Field in Baja California, Mexico, San Francisco, Mar 1982
(Contract DE-AT03-80SF-11458)
(DE82-001077, CONF-810399-1, REPT-81-9) Avail. NTIS HC A02/MF A01

Paleotemperatures different from the present thermal regime were studied by examining coexisting mineral systems which exchanged their oxygen with the geothermal brines at different rates. Oxygen isotopic compositions were measured in drill cuttings and core and core samples from more than 40 wells. Oxygen isotopic profiles of pore filling calcites in sandstones are a measure of the recent equilibrium temperature distribution. A three dimensional map was developed, showing the equilibrium temperatures in the geothermal field. A mass balance calculation was performed using measured ^{18}O enrichment of the geothermal brine. This calculation implies an overall water: rock volume ratio of approximately 3:1 during the history of the Cerro Prieto system. GRA

04 FUELS AND OTHER SOURCES OF ENERGY

N83-16910# Sandia Labs., Albuquerque, N Mex CHARACTERIZATION AND SUPPORTING RESEARCH FOR IN-SITU COAL-GASIFICATION RESEARCH AND DEVELOPMENT PROJECT PLAN

S L LOVE Aug. 1982 38 p refs

(Contract DE-AC04-76DP-00789)

(DE83-000962, SAND-82-0494) Avail NTIS HC A03/MF A01

Of the remaining problems with underground coal gasification (UCG) technology, perhaps the most significant is the inability to reliably forecast test results. Experience now indicates that to anticipate test results, one must be able to forecast the evolving shape of the underground reaction zone. Further, the most important factors governing this cavity growth may be the initial site and process conditions. A research plan which is designed to provide the needed UCG characterization in terms of cavity growth as determined by the nature of the UCG site is described. Laboratory and small-scale field investigations are proposed which should define the characteristics of sites that are suitable for UCG; identify and quantify the key process factors; and develop mathematical models which can be used to forecast site-specific test results. Included are task descriptions and objectives, time scales, and budget estimates. DOE

N83-16913# Zaininger Engineering Co., San Jose, Calif BENEFITS TO UTILITY SYSTEMS OF COPRODUCTION OF METHANOL AND ELECTRICITY Final Report

H W ZAININGER and D. J BELL Sep 1982 66 p refs

Sponsored by Electric Power Research Inst

(Contract EPRI PROJ TPS-81-781)

(DE83-900279, EPRI-AP-2587) Avail NTIS HC A04/MF A01

One potential alternative to petroleum oil for electric power generation is methanol produced by adding a once-through methanol synthesis to coal gasification-combined cycle plants. An initial assessment of the potential benefits of installing methanol and electricity coproduction units was performed. Results indicate substantial potential savings to systems using relatively large quantities of oil-fired generation by adding once-through methanol synthesis to coal gasification-combined cycle units. Although potential savings are less for utility systems using a large percentage of coal-fired generation, total capital requirements for expanding such systems could be reduced, even though capital must be spent for the methanol producing facilities. DOE

N83-16928# Battelle Columbus Labs., Ohio

BIOMASS COGENERATION: A BUSINESS ASSESSMENT

J C SKELTON Nov 1981 37 p refs

(Contract DE-AC02-79CS-30159)

(DE82-011773, WSUN-113) Avail NTIS HC A03/MF A01

The biomass cogeneration was reviewed. The business assessment is based in part on discussions with key officials from firms that have adopted biomass cogeneration systems and from organizations such as utilities, state and federal agencies, and banks directly involved in a biomass cogeneration project. The guide is organized into five chapters: biomass cogeneration systems, biomass cogeneration business considerations, biomass cogeneration economics, biomass cogeneration project planning, and case studies. GRA

N83-16975# Tennessee Valley Authority, Muscle Shoals, Ala. PROGRAMMATIC ENVIRONMENTAL OVERVIEW. BIOMASS FUELS PROGRAM

J C BOETHELI, R P BESON, C E BOHAC, R H. GINN, P M GIORDANO, S W JAMISON, J. E JORDAN, J. M LONEY, D. M MCCARTHY, W H. OGDEN et al Jul 1982 24 p refs
(DE82-906065; TVA/OACD-82/16) Avail NTIS HC A02/MF A01

Some potential environmental issues related to use of renewable biomass resources as fuels are identified. Possible management strategies for eliminating or holding the consequences within manageable bounds are suggested. Production impacts are discussed as follows: soil erosion, water quality, soil/stand productivity, and aesthetics, wildlife, and related areas. Conversion

and combustion impacts on air quality, water quality, and solid wastes are described. DOE

N83-16993*# Jet Propulsion Lab., California Inst of Tech., Pasadena

A STUDY OF THE UNITED STATES COAL RESOURCES

J C FERM and P J. MUTHIG 15 Sep 1982 121 p refs

Sponsored by NASA and DOE

(NASA-CR-169792; JPL-PUB-82-14; NAS 1.26:169792,

DOE/ET-12548/15) Avail NTIS HC A06/MF A01 CSCL 08G

Geologically significant coal resources were identified. Statistically controlled tonnage estimates for each resource type were prepared. Particular emphasis was placed on the identification and description of coals in terms of seam thickness, inclination, depth of cover, discontinuities caused by faulting and igneous intrusion, and occurrence as isolated or multiseam deposits. The national resource was organized into six major coal provinces: the Appalachian Plateau, the Interior Basins, the Gulf Coastal Plain, the Rocky Mountain Basins, the High Plains, and North Alaska. Each basin within a province was blocked into subareas of homogeneous coal thickness. Total coal tonnage for a subarea was estimated from an analysis of the cumulative coal thickness derived from borehole or surface section records and subsequently categorized in terms of seam thickness, dip, overburden, multiseam proportions, coal quality, and tonnage impacted by severe faulting and igneous intrusions. Confidence intervals were calculated for both subarea and basin tonnage estimates. Author

N83-17000# Los Alamos Scientific Lab., N Mex.

LITHOLOGY AND HYDROTHERMAL ALTERATION DETERMINATION FROM WELL LOGS FOR THE CERRO PRIETO WELLS, MEXICO

I ERSHAGHI, S GHAEMIAN, and D ABDASSAH Oct 1981 33 p refs

(Contract W-7405-ENG-36)

(DE82-004677, LA-9075-MS) Avail: NTIS HC A03/MF A01

The characteristics of geophysical well logs are compared against the sand-shale series of the sedimentary column of the Cerro Prieto Geothermal Field, Mexico. It is shown that the changes in mineralogy of the rocks because of hydrothermal alteration are not easily detectable on the existing logs. However, if the behavior of clay minerals alone is monitored, the onset of the hydrothermally altered zones may be estimated from the well logs. The effective concentration of clay-exchange cations, $Q_{\text{sub}} v$, is computed using the data available from conventional well logs. Zones indicating the disappearance of low temperature clays are considered hydrothermally altered formations with moderate to high permeability and temperature, and suitable for completion purposes. DOE

N83-17023# Pacific Northwest Lab., Richland, Wash

THE WIND CHARACTERISTICS PROGRAM

L L. WENDELL Oct 1981 12 p refs Presented at the Wind Workshop 5, Washington, D C, 7-9 Oct. 1981

(Contract DE-AC06-76RL-01830)

(DE82-005226, PNL-SA-9741, CONF-811043-14) Avail NTIS HC A02/MF A01

Wind characteristics research activities over the past 4 years focused on the areas of wind resource assessment, site selection and evaluation techniques, and on wind characteristics for wind turbine design, performance and operations evaluation. An analysis of the wind resources of the United States and its territories was completed that shows the greatest area of high wind power resource to be in the midsection of the country. High wind power is available in other sections of the country and is described in some detail on a state-by-state basis in twelve regional atlases. To carry the wind prospecting process to a finer scale, site selection techniques for small and large wind turbines were developed, tested, and documented. There is a broad range of sophistication and reliability in these techniques and their application must be matched with the priorities and time available for energy planning efforts. The nature of wind gustiness was evaluated statistically.

04 FUELS AND OTHER SOURCES OF ENERGY

and modeled for calculating fatigue cycles and extreme events.
DOE

N83-17024# Pacific Northwest Lab, Richland, Wash
WORLD-WIDE RESOURCE ASSESSMENT
D L. ELLIOT, C. I. ASPLIDEN, and N J. CHERRY (Lincoln Coll.)
Oct. 1981 13 p refs Presented at the 5th Bienn. Wind
Energy Conf and Workshop, Washington, D.C., 7-9 Oct 1981
(Contract DE-AC06-76RL-01830)
(DE82-004272, PNL-SA-9742; CONF-811043-13) Avail: NTIS
HC A02/MF A01

A world-wide wind energy resource assessment was carried out. The assessment was made using the methods recently developed to critically analyze all available wind data and previous assessments in order to estimate the broad-scale distribution of wind energy flux (WEF) over the world. Much of the data was used cautiously because of the lack of anemometer height and exposure information. Global pressure and wind patterns, upper air wind data and boundary layer meteorology were used to obtain a consistent estimate of the wind energy resource. The assessment made refers to the magnitude of the WEF at 50 m above ground level at typical open, well-exposed sites. It is presented on a world map with the assessment presented on a color scale of wind energy class.
DOE

N83-17027# Pennsylvania State Univ, University Park
SPECTRA OVER COMPLEX TERRAIN IN THE SURFACE LAYER
H A. PANOFKY, J. A. DUTTON, D. LARKO, R. LIPSCHULTZ, and G. STONE. Richland, Wash. Pacific Northwest Lab. Sep 1982 99 p refs
(Contract DE-AC06-76RL-01830)
(DE83-000502, PNL-3745) Avail: NTIS HC A05/MF A01

Velocity spectra and other velocity statistics are estimated over three types of complex terrain: on tops of hills or escarpments, on land a short distance downwind from a water body; and over rolling farm land. The most important characteristics of turbulence models over uniform terrain are summarized briefly. Theoretical aspects of spectral characteristics over complex terrain are discussed, followed by detailed observations over complex terrain and procedures for their estimation. A theory is presented for calculation of response of engineering systems to wind fluctuations.
DOE

N83-17028# Pacific Northwest Lab, Richland, Wash
CANDIDATE WIND-TURBINE-GENERATOR SITE SUMMARIZED METEOROLOGICAL DATA FOR THE PERIOD DECEMBER 1976 THROUGH DECEMBER 1981
W. F. SANDUSKY, D. S. RENNE, and D. L. HADLEY. Sep 1982 195 p
(Contract DE-AC06-76RL-01830)
(DE83-000884, PNL-4407) Avail: NTIS HC A09/MF A01

Summarized hourly meteorological data for 16 of the original 17 candidate and wind turbine generator sites collected during the period from December 1976 through December 1981 are presented. The data collection program at some individual sites may not span this entire period, but will be contained within the reporting period. The purpose of providing the summarized data is to document the data collection program and provide data that could be considered representative of long-term meteorological conditions at each site. For each site, data are given in eight tables and a topographic map showing the location of the meteorological tower and turbine, if applicable. Use of information from these tables, along with information about specific wind turbines, should allow the user to estimate the potential for long-term average wind energy production at each site.
DOE

N83-17051# Indiana Biolab, Palmyra.
MICROORGANISMS FOR FERMENTATION OF CROP RESIDUES
Final Technical Report
H. EDDLEMAN. 1981 2 p
(Contract DE-FG02-80R5-10222)
(DE82-006912, DOE/R5-10222/1) Avail: NTIS HC A02/MF A01

The construction of a device for freeze drying cultures and the accumulation of about 200 fungi which decompose cornstalks are described.
DOE

N83-17414*# OAO Corp., Greenbelt, Md
THE NON-FEDERAL OCEANOGRAPHIC COMMUNITY: AN OVERVIEW
M. A. SWETNICK. Nov 1981 181 p
(Contract NASW-3358)
(NASA-CR-169802; NAS 1.26:169802, OAO/TR-81/0056) Avail: NTIS HC A09/MF A01 CSCL 05B

A portion of the broad domestic non-Federal oceanographic community that represents a potential market for satellite remote sensor derived oceanographic data and/or marine environmental information is presented. The overview consists of listings of individuals and/or organizations who have used, or are likely to use such data or information for scientific research, offshore engineering purposes, marine resources exploration and utilization, marine related operational applications, or coastal zone management.
S. L.

N83-17638# Colorado School of Mines, Golden. Dept of Chemical and Petroleum Refining Engineering.
PHASE EQUILIBRIUM PROPERTIES OF COAL DERIVED LIQUIDS Technical Progress Report, Jul. - Dec. 1981
V. F. YESAVAGE and A. J. KIDNAY. 1 Jan. 1982 21 p
(Contract DE-FG22-80PC-30230)
(DE82-007006; DOE/PC-30230/23) Avail: NTIS HC A02/MF A01

The objective of the present study is to measure equilibrium K values of coal derived liquids and model compounds representative of coal liquids, and to use the results in the development of engineering correlations. The program is divided into three major areas: (1) Design, construction, and evaluation of an equilibrium flash vaporization system for temperatures between 70 and 700 F, at pressures up to 2000 psia, (2) Measurements on samples of both coal derived liquids and mixtures of model compounds, (3) Preparation of engineering correlations for the measured K values and vapor liquid equilibria. Calibration of the pressure and temperature measuring equipment was completed. The system was tested for a single component system by reproducing the vapor pressure curve for pure water. Work was started on the water ethanol binary system and one data point was obtained. These components were selected because reliable data for these components are available for comparison.
DOE

N83-17639# Washington State Univ, Pullman. Dept of Mechanical Engineering.
CHARACTERISTICS OF COAL/LIGHT HYDROCARBON SLURRIES IN SPRAY COMBUSTION Quarterly Progress Report, 1 Sep. - 30 Nov. 1981
W. L. GROSSHANDLER, C. T. CROWE, and J. N. CHUNG. Dec 1981 17 p
(Contract DE-FG22-80PC-30216)
(DE82-006294, DOE/PC-30216/T3) Avail: NTIS HC A02/MF A01

Research activities are summarized. Some progress on each of the three major tasks has been accomplished, but no new significant results have been obtained. A redesign of the spray facility is underway to give more reliable size distribution measurements. The numerical model is being expanded to include evaporation and combustion in both the high and low Reynolds number limits. Recent measurements of temperature within the opposed flow diffusion burner are reported for air/propane mixtures. Attempts to measure coal particle velocity in cold flow tests are also discussed.
DOE

N83-17640# Department of Energy, Portland, Ore
**COMBUSTION OF SOLVENT-REFINED COAL IN A 100 HP
 FIRETUBE BOILER Final Test Report**

Y S PAN, D E WIECZENSKI, R B SNEDDEN, G T BELLAS,
 J I JOUBERT, A R CURIO, and D J WILDMAN 1982 48 p
 refs
 (DE82-007670, DOE/PETC/TR-82/5) Avail NTIS HC A03/MF
 A01

Although solid Solvent Refined Coal (SRC-1) was burned
 successfully in a coal designed utility boiler in 1977, the feasibility
 of using this fuel in more compact oil or gas designed units at
 significantly higher heat liberation rates remained uncertain
 Combustion tests were conducted at the Pittsburgh Energy
 Technology Center using a 100 hp (3450 lb of steam per hour)
 firetube boiler, designed to burn No. 6 oil The test results indicate
 that SRC-1, including the solid form, can probably be burned without
 derating in larger oil designed industrial boilers of watertube design
 Such units usually operate at heat liberation rates in the range of
 25,000-50,000 Btu/cu ft hr, significantly lower than rates employed
 in these tests DOE

N83-17641# Battelle Columbus Labs, Ohio
**CAO INTERACTIONS IN THE STAGED COMBUSTION OF COAL
 Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1981**

A LEVY, E L MERRYMAN, and B W RISING 1988 38 p
 refs
 (Contract DE-AC22-80PC-30301)
 (DE82-010299, DOE/PC-30301/5, QTPR-5) Avail NTIS HC
 A03/MF A01

Study of the reaction of sulfur bearing compounds with CaO
 to form CaS was completed A study of the oxidation of CaS is
 well underway and a study of kinetic and chemical parameters
 governing CaS and CaSO₄ formation in staged combustion, was
 continued The results suggest that CaS oxidation to sulfate in
 the second stage of a two-stage combustion process may not
 proceed very rapidly Results to date from the methane-coal studies
 show that sulfur retention in fuel-rich firings is dependent on
 reaction temperature and equivalence ratio DOE

N83-17645# General Electric Co., Schenectady, N Y
**CATALYTIC EFFECTS OF ALKALI METAL SALTS IN THE
 GASIFICATION OF COAL CHAR**

D W MCKEE, C L SPIRO, P G KOSKY, and E J LAMBY
 1982 30 p refs Presented at the 183rd Am Chem Soc Ann
 Meeting Symp. on Coal Gasification, Las Vegas, Nev., 28 Mar. -
 2 Apr 1982
 (Contract DE-AC21-80MC-14591)
 (DE82-000850, CONF-820304-2) Avail NTIS HC A03/MF A01

The kinetics of gasification, in carbon dioxide and steam, of a
 char derived from Illinois No. 6 coal doped with small amounts of
 alkali metal salts are discussed A progressive loss in catalytic
 activity was observed during the course of the steam gasification
 reaction at 700 to 1000 C and on thermal cycling between
 gasification temperatures and 25 C This deactivation appeared to
 result from reaction of the alkali salts with mineral matter in the
 char The catalytic behavior of the alkali carbonates are discussed
 in terms of sequences of elementary reactions involving interaction
 of the catalyst particles with the carbon substrate and with the
 gaseous environment DOE

N83-17646# Exxon Research and Engineering Co., Linden, N.J.
**SYNTHETIC FUEL EFFECTS IN CONTINUOUS COMBUSTION
 SYSTEMS: AN EXPERIMENTAL STUDY OF FUEL NITROGEN
 CONVERSION IN JET-STIRRED COMBUSTIONS**

R M KOWALIK and L A RUTH 1982 24 p refs Presented
 at the 183rd Am Chem Soc. Ann Meeting Symp on the
 Combustion of Synthetic Fuels, Las Vegas, Nev., 29 Mar. - 2 Apr.
 1982
 (Contract DE-AC22-77ET-11313)
 (DE82-002686, CONF-820304-7) Avail NTIS HC A02/MF A01

Results from laboratory jet stirred combustor experiments
 suggest that the conversion of fuel bound nitrogen to total fixed
 nitrogen (TFN) in fuel rich mixtures is strongly related to the

concentration of unburned hydrocarbons (HCs) within the
 combustor. Most conversion trends with equivalence ratio,
 residence time, and combustor type may be explained in terms of
 the effects of these variables on HC concentrations Changes in
 these variables which reduce HC's generally reduce the degree
 of fuel nitrogen conversion Fuel type (isooctane vs toluene) effects
 on conversion appear to be most pronounced for very rich ($\phi \approx$
 1.8), short residence time (τ or ≈ 10 ms) conditions At these
 conditions toluene mixtures produce less TFN and more soot
 This trend may be related to an interaction between soot and
 HCN. DOE

N83-17647# SRI International Corp., Menlo Park, Calif
**WORKSHOP ON THE STATUS OF INDUSTRIAL ORGANIC
 ELECTROCHEMISTRY, SUMMARY**

K KINOSHITA, R D WEAVER, and L NANIS (Electrochemical
 Engineering) Dec 1981 94 p refs Workshop held at Menlo
 Park, Calif., 9 Apr 1981 Sponsored by Electric Power Research
 Inst.

(Contract EPRI PROJ 1086-9)
 (DE82-901982, EPRI-EM-2173, CONF-8104138-SUMM) Avail
 NTIS HC A05/MF A01

The status of electrochemical synthesis of industrially important
 organic compounds was discussed Interest in electroorganic
 synthesis stems from the desire of the utility industry to substitute
 base load electricity derived from coal fired or nuclear plants in
 place of oil and gas used in the chemical industry for feedstock
 and process heating Electroorganic syntheses would appear to
 offer such opportunities The objectives of the workshop were to
 analyze the state of technology of industrial organic
 electrochemistry, to discuss the obstacles, and to consider possible
 methods to advance the development of electroorganic processes
 A series of prepared presentations by speakers with industrial
 and academic research experience served to define the progress,
 problems, and prospects for electrochemical synthesis of organic
 compounds. DOE

N83-17651# California Univ., Livermore. Lawrence Livermore
 Lab
**RECENT FLAME-PROPAGATION EXPERIMENTS AT LLNL
 WITHIN THE LIQUEFIED GASEOUS-FUELS SPILL-SAFETY
 PROGRAM**

P A URTIEW Dec 1981 28 p refs Presented at the
 Intern Spec Meeting on Fuel-Air Explosion, Montreal, 4-6 Nov
 1981

(Contract W-7405-ENG-48)
 (DE82-010729, UCRL-87012, CONF-811124-5) Avail NTIS HC
 A03/MF A01

The possible hazardous consequences of large spills of liquefied
 natural gas are currently under investigation by our Laboratory,
 under the Liquefied Gaseous Fuels Spill Safety Program One of
 the important aspects of the problem is the actual burning of the
 cloud and all the potential outcomes resulting from it Described
 here, are current experimental efforts in this area both in small
 scale laboratory experiments and large scale field tests The results
 of laboratory experiments conducted in semiconfined geometries
 suggest a strong role of obstacles in the flow These obstacles
 can produce turbulence in the flow, and thus, accelerate the flame
 to several times the laminar burning velocity The large scale vapor
 burn tests in the unconfined cloud have not yet been adequately
 analyzed, but they show some interesting features which are also
 discussed DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-17652# Los Alamos Scientific Lab., N. Mex
RELATIONSHIP BETWEEN PYRITE FORMATION AND ORGANIC SULFUR CONTENT OF COAL AS REVEALED BY ELECTRON MICROSCOPY

R. RAYMOND, JR. and R. C. HAGAN 1982 19 p refs
Presented at the Scanning Electron Microscop. Conf., Anaheim, Calif. 19-23 Apr. 1982

(Contract W-7405-ENG-36)

(DE82-010417; LA-UR-82-113; CONF-820409-2) Avail NTIS
HC A02/MF A01

There are a large number of questions concerning the mode of occurrence of organic sulfur in peat, and what, if anything, alters its occurrence during and after coalification. The formation of pyrite during periods of peatification and coalification has been hypothesized to have a great effect on the organic sulfur content of organic material surrounding the pyrite. Measurement of organic sulfur contents at different distances from pyrite particles would serve as direct experimental proof for or against this hypothesis. A combination of in situ energy dispersive spectrometer line profiles, EDS X-ray maps, and WDS analyses across pyrite/coal interfaces in a variety of coals shows unequivocally that formation of pyrite does not alter the organic sulfur contents of the surrounding coal macerals. DOE

N83-17655# Washington Univ., St. Louis, Mo. Dept of Chemical Engineering.

THEORETICAL AND EXPERIMENTAL STUDIES OF FIXED-BED COAL GASIFICATION REACTORS Semiannual Technical Progress Report, 1 Sep. 1981 - 28 Feb. 1982

B. JOSEPH and M. P. DUDUKOVIC Mar 1982 16 p refs

(Contract DE-FG22-80PC-30219)

(DE82-009515; DOE/PC-30219/T2) Avail: NTIS HC A02/MF A01

The existing dynamic model of a fixed bed coal gasification reactor was modified to simulate the performance of the fixed bed laboratory reactor. The design of a laboratory fixed bed reactor was completed and construction is under way. Research plans are discussed. DOE

N83-17657# Pittsburgh and Midway Coal Mining Co., Englewood, Colo

SOLVENT-REFINED-COAL (SRC) PROCESS. COKING OF SRC-2 PROCESS STREAMS. PART 3: EFFECTS OF COAL MINERALS ON COKING. PART 4: THERMAL PROPERTIES OF SRC-2 COKES AND PROCESS STREAMS Interim Report, Jan. - Sep. 1981

C. S. WEN Apr 1982 90 p refs

(Contract DE-AC05-76ET-10104)

(DE82-012369; DOE/ET-10104/38-PT-3-PT-4) Avail NTIS HC A05/MF A01

Studies were made to determine the effects of inherent coal minerals, in particular pyrite/pyrrhotite and kaolinite clay, on coking during coal liquefaction. The results indicated and confirmed that certain coal minerals (pyrite/pyrrhotite) very likely suppress coke formation and others (clays) promote coke formation by acting as coke nucleating agents during coal liquefaction. The thermal behavior of solvent refined coal-2 (SRC-2) process streams and coke like solids was investigated to better understand the mechanism of coke formation during coal liquefaction. Experiments were carried out using pressure differential scanning calorimetric/thermogravimetric techniques in conjunction with Fourier Transform Infrared to determine thermal properties of various SRC-2 cokes and process streams. A correlation between coke heat capacity/enthalpy and their coking parameters was established. Thermal properties of cokes were fit to a set of equations as functions of operating parameters. DOE

N83-17661# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho

EFFECT OF SIMULATED MEDIUM-BTU COAL GASIFIER ATMOSPHERES ON THE BIAxIAL STRESS RUPTURE BEHAVIOR OF FOUR CANDIDATE COAL GASIFIER ALLOYS

R. M. HORTON and G. R. SMOLIK 1982 23 p refs
Presented at the 111th AIME Ann Meeting, Dallas, 14-18 Feb. 1982

(Contract DE-AC07-76ID-01570)

(DE82-008607; EGG-M-03182; CONF-820205-3) Avail: NTIS
HC A02/MF A01

Tests were conducted to determine whether the biaxial stress rupture behavior of four alloys was adversely affected by exposure to four simulated medium-Btu coal gasifier atmospheres. The results of exposures up to approximately 500 hours at temperatures between 649 and 982 C are presented. Exposure to these atmospheres at temperatures below 900 C did not significantly reduce the rupture properties from those measured in air. Only at 982 C were the rupture strength and life in the simulated coal gasifier atmospheres lower than those measured in air at atmospheric pressure. Possible reasons for this reduction in strength/life are discussed. The results of detailed examination of specimen ruptures are also presented. DOE

N83-17670# Wisconsin Univ., Madison Alternative Fuels Utilization Program

FUEL-COMPOSITION AND -VAPORIZATION EFFECTS ON COMBUSTION-CHAMBER DEPOSITS

P. S. MEYERS, O. A. UYEHARA, and R. DEYOUNG Dec 1981 143 p refs

(Contract DE-FG01-79CS-50020)

(DE82-012576; DOE/CS-50020/1) Avail: NTIS HC A07/MF A01

It is known that gasoline extracted from coal and shale oil sources has higher end point fraction and higher aromatic content (hereafter known as HEPHAG) than typical normal end point gasoline (NEPG). Further, it is known that these HEPHAG can cause objectionable combustion chamber deposits (CCD). It was of practical interest (and the purpose of this thesis) to investigate whether HEPHAG would give acceptable combustion chamber deposits (i.e. comparable to NEPG) if introduced into a SI engine in a vaporized and homogeneous (gas phase) form. An analysis of the single cylinder results showed that regardless of the fuel, CCD decreased significantly when the fuel-air charge conditions were judged to be primarily gas phase. However, HEPHAG required a higher fuel-air charge temperature (FACT) than NEPG to realize this gas phase condition. An analysis of the multicylinder results showed that the vortex helped approach an equilibrium condition. Also, under conditions of high FACT and using the vortex, there was little difference in CCD formation between HEPHAG and NEPG tests. DOE

N83-17676# Exxon Research and Engineering Co., Bayton, Tex

CATALYTIC COAL GASIFICATION: AN EMERGING TECHNOLOGY FOR SNG

R. R. LESSARD and R. A. REITZ 1981 26 p refs

(Contract DE-AC01-78ET-13005)

(DE82-007596; DOE/ET-13005/T13) Avail: NTIS HC A03/MF A01

It was found that potassium salts added to coal promotes the methanation of coal gasification products. This discovery led to Exxon's catalytic coal gasification (CCG) process. In the CCG process, coal with added potassium salts is gasified in a fluid bed at about 1300 F and 500 psia. Since lower temperatures and higher pressure favor methane formation, the gasification reactor has a high methane yield. By separating and recycling unconverted CO and H₂ back to the reactor, a single reaction step process is obtained. An advantage of CCG is that the heat release from methanation is in the gasifier where it provides essentially all of the heat needed for gasification. This eliminates the need for oxygen or other complex gasifier heat input methods. Thermal efficiency of CCG ranges from 60 to 70% depending on coal.

04 FUELS AND OTHER SOURCES OF ENERGY

feed properties. Process development work was carried out in bench scale equipment and pilot plants. DOE

N83-17677# Colorado School of Mines, Golden Dept. of Chemical and Petroleum Refining Engineering
MECHANISMS AND KINETICS OF COAL HYDROGENATION
Quarterly Progress Report, Oct. - Dec. 1981
R. M. BALDWIN Mar 1982 62 p refs
(Contract DE-AC22-79ET-14881)

(DE82-012338, DOE/ET-14881/8) Avail NTIS HC A04/MF A01
Data for coal hydrogenation in the presence of added H₂S, pyrite, and H₂S plus pyrite are given along with baseline data for hydrogenation without the use of additives. What is perhaps most striking about these data is the influence of added H₂S in absence of added pyrite. The percentage of H₂S refer to the mole percentage of H₂S in the gas atmosphere prior to heating and reaction (cold composition). A 56% increase in overall conversion is indicated at the 10 minute residence time, with a 21% increase at 60 minutes when gaseous H₂S alone is added to the reaction gas atmosphere. The predominate influence on product distribution is in the preasphaltene fraction, especially at the short residence time. Clearly, H₂S is acting as a catalyst for coal liquefaction at these conditions. Concentrations above 2% H₂S in the initial gas phase mixture do not seem to appreciably increase the conversion; the effect noted at 60 minutes between 5% and 10% may not be significant due to scatter in the data. DOE

N83-17678# McKee (Davy) Corp., Cleveland, Ohio
DEVELOPMENT OF STANDARDS AND A COST MODEL FOR COAL AGGLOMERATION AND RELATED STUDIES
S. G. NELSON, O. A. KUBY, F. A. KOROSI, and M. O. PAULIN
26 Feb 1982 43 p refs
(Contract DE-AC01-81FE-05147)
(DE82-011047, DOE/FE-05147/T2) Avail NTIS HC A03/MF A01

Several topics concerning coal agglomeration and fixed-bed coal gasification, as they relate to an agglomeration-process development program are discussed. Specific topics include an examination of the performance of coals in fixed-bed gasifiers, the development of properties' standards by which agglomerates produced in the program may be compared, the development of a cost model to judge the economic feasibility of coal agglomeration for potential users and the maximum binder levels to be considered in the program, the definition of a suitable briquette size for coal gasification, and a study of upgrading methods at the mines to improve agglomeration. Extensive property data and the results of a number of special tests on six coals (Pittsburgh No. 8 bituminous coal, Illinois No. 6 bituminous coal, Wyoming Bighorn subbituminous coal, Montana Rosebud No. 14 subbituminous coal, North Dakota Indian Head lignite and Pennsylvania Nanoth anthracite coal) and on FMC formcoke and Simplex briquettes are reported. DOE

N83-17707# Electric Power Research Inst., Palo Alto, Calif. Materials Support Group
SOME 2 1/4CR-1 MO STEELS FOR COAL-CONVERSION PRESSURE VESSELS
R. VISWANATHAN and R. I. JAFFE Nov 1981 35 p refs
(Contract EPRI PROJ RP-559)
(DE82-901349, EPRI-RD-2143-SR) Avail NTIS HC A03/MF A01

Pressure vessels for coal conversion processes are likely to be made of a 2 1/4 Cr-1 Mo steel, covered by American Standards for Testing Materials specification A387, class 2, grade 22. Under the projected operating conditions, degradation of the mechanical properties of the steel by temper embrittlement, hydrogen embrittlement and hydrogen attack is a major concern. The significance of these degradation mechanisms is reviewed in the light of recently generated experimental results. DOE

N83-17708# Oak Ridge National Lab., Tenn. Metals and Ceramics Div
RESULTS OF U-BEND STRESS-CORROSION-CRACKING SPECIMEN EXPOSURES IN COAL-LIQUEFACTION PILOT PLANTS

V. B. BAYLOR, J. R. KEISER, M. D. ALLEN, M. HOWELL, and J. F. NEWSOME Apr 1982 40 p refs
(Contract W-7405-ENG-26)
(DE82-012889, ORNL/TM-8194) Avail NTIS HC A03/MF A01

The application of austenitic stainless steels that are susceptible to stress corrosion cracking to coal gasification pilot plants is discussed. This cracking results from tensile stresses in combination with offensive agents such as polythionic acids, chlorides, and caustics. To screen candidate construction materials for resistance to stress corrosion cracking, racks of stressed U-bend specimens were exposed in welded and as-wrought conditions at four coal liquefaction pilot plants. The on-site test results from June 1980 through October 1981 for the two pilot plants and the H-Coal and Exxon coal liquefaction pilot plants are given. DOE

N83-17726# Shell Oil Co., Houston, Tex.
COALINGA POLYMER DEMONSTRATION PROJECT Final Report, Jul. 1976 - Dec. 1980

J. E. PETERSON Dec. 1981 270 p refs
(Contract DE-AC03-77ET-13001; EF-77-C-03-1556)
(DE82-007019, DOE/SAN-1556/5) Avail NTIS HC A12/MF A01

Water injection began in June 1976 and continued through April 1978. Polymer was injected continuously in the four pilot injectors from May 1978 to October 1979. Water injection was resumed from November 1979 to December 1980. The overall production performance for the pilot was far less than expected. Oil production rate was below the expected primary decline rate when the project was terminated in December 1980. Though the operation of the polymer injection facilities met or exceeded the specifications required, polymer injectivity was substantially lower than predicted (200 BPD actual versus 1000 BPD minimum predicted). Reservoir parameters at the beginning of the project (July 1976) were reassessed with new petrophysical and performance data. Results of this study indicate that existing oil saturations were only 0.39 versus 0.54 originally predicted. The waterflood residual oil saturation was also increased from 0.235 to 0.28. Thus, the waterflood target was greatly reduced. Final results indicate that polymer flooding is not a viable process in the Zone II Temblor sands in this portion of the East Coalinga Field. DOE

N83-17728*# United Technologies Research Center, East Hartford, Conn.
EXPERIMENTAL STUDY OF THE THERMAL STABILITY OF HYDROCARBON FUELS

P. J. MARTENEY, M. B. COLKET, and A. VRANOS Dec. 1982 70 p refs
(Contract NAS3-22511)
(NASA-CR-168027, NAS 1 26 168027, R82-955319-20) Avail NTIS HC A04/MF A01 CSCL 21D

The thermal stability of two hydrocarbon fuels (premium diesel and regular diesel) was determined in a flow reactor under conditions representing operation of an aircraft gas turbine engine. Temperature was varied from 300 to 750 F (422 to 672 K) for fuel flows of 2.84 to 56.8 liters/hr (corresponding to 6.84 x 0.00010 to 1.63 x 0.010 kg/sec for regular diesel fuel and 6.55 x 0.00010 to 1.37 x 0.010 kg/sec for premium diesel fuel); test times varied between 1 and 8 hr. The rate of deposition was obtained through measurement of weight gained by metal discs fixed along the channel wall. The rate of deposit formation is best correlated by an Arrhenius expression. The sample discs in the flow reactor were varied among stainless steel, aluminum and brass; fuels were doped with quinoline, indole, and benzoyl peroxide to yield nitrogen or oxygen concentrations of approximately 1000 ppm. The most substantial change in rate was an increase in deposits for brass discs; other disc materials or the additives caused only small

04 FUELS AND OTHER SOURCES OF ENERGY

perturbations. Tests were also conducted in a static reactor at temperatures of 300 to 800 F for times of 30 min to 2 1/2 hr. Much smaller deposition was found, indicating the importance of fluid transport in the mechanism. Author

N83-17729# Technion - Israel Inst of Tech, Haifa Dept. of Aeronautical Engineering.

THE USE OF SLURRY FUELS IN INDUSTRIAL FURNACES

Y. M. TIMNAT, C. PRESSER, and Y. GOLDMAN Nov. 1980 14 p refs Sponsored by Kernforschungsanlage (TAE-428) Avail: NTIS HC A02/MF A01

The feasibility of using coal/oil slurries in the experimental, industrial type furnace is discussed. The research to be performed is outlined. Interest in such slurries is growing as a result of the increased demand for coal. Such mixtures will aid in reducing oil consumption and ease the burden on the coal mining industry until it will be able to handle future demand. The mixing of the coal oil slurry and the monitoring of the volumetric flow rate are discussed R.J.F.

N83-17732# Ashland Synthetic Fuels, Inc., Ky

H-COAL PILOT PLANT. PHASE 2: CONSTRUCTION AND PHASE 3: OPERATION Annual Report

1 Dec. 1981 25 p

(Contract DE-AC05-76ET-10143)

(DE82-005117, DOE/ET-10143/T10, AR-4) Avail: NTIS HC A02/MF A01

Construction work was completed in March 1981, within budget and without delaying operations. Engineering design solutions were completed for problems encountered with such equipment as the High Pressure Letdown Valves, Slurry Block Valves; Slurry Pumps; and Flakers; and, the Vacuum Tower. The erosion and corrosion program continued. The Quality Assurance program was substantially revised. Significant progress was made in operating the Plant. Environmental and health programs continued to provide worker safety and protection and to obtain data for scientific analysis. Significant progress was made in revising the Waste Water Treatment Plant. DOE

N83-17734# Pacific Northwest Lab, Richland, Wash.

METHANOL SYNTHESIS GAS FROM CATALYTIC STEAM REFORMING OF WOOD

L. K. MUDGE, D. H. MITCHELL, R. J. ROBERTUS, S. L. WEBER, and L. J. SEALOCK, JR. 1981 11 p refs Presented at the 2nd Brazilian Energy Congr, Rio de Janeiro, 6-10 Apr. 1981 (Contract DE-AC06-76RL-01830)

(DE82-006082; PNL-SA-8991, CONF-8104136-1) Avail: NTIS HC A02/MF A01

Catalyst systems and operating conditions for generation of a methanol synthesis gas, a mixture of hydrogen, carbon monoxide and carbon dioxide were developed. Some methane remained in the gas mixture. Wood was reacted with steam at a steam to wood weight ratio of about 0.9 and a temperature of 750 C (1380 F) in the presence of several catalysts. Results are presented for two different catalyst systems. DOE

N83-17735# Technical Univ. of Denmark, Lyngby Lab. for Energiteknik.

TECHNICAL STANDARDS FOR FUEL CONSUMPTION IN PRIVATE AUTOMOBILES

N. RASMUSSEN and P. S. PEDERSEN 1981 111 p refs In DANISH

(DE82-900748; DTH-LET-RE-81-1) Avail: NTIS (US Sales Only) HC A06/MF A01; DOE Depository Libraries

Consumer information about fuel consumption of various car makes is discussed. It was decided in Denmark to distribute a yearly official leaflet with standardized measurements of fuel consumption at constant speed of 90 km/h in city driving and mixed driving, information about expenses for yearly 15,000 km driving, weight tax, and other taxes. Regulations of fuel consumption were rejected, but assumptions were investigated through computer simulation. DOE

N83-17736# Atlantic Research Corp., Alexandria, Va

FURTHER DEVELOPMENT AND EVALUATION OF COAL-WATER MIXTURE TECHNOLOGY

R. S. SCHEFFEE, E. G. SKOLNIK, N. P. ROSSMEISSEL, H. L. HEATON, and E. T. MCHALE 1982 13 p refs Presented at the 4th Intern. Symp. on Coal Slurry Combustion, Orlando, Fla., 10 May 1982

(Contract DE-AC22-80PC-30185)

(DE82-010518; CONF-820519-1) Avail: NTIS HC A02/MF A01

Four different eastern bituminous coals having size consists ranging from 60 to 100% minus 200 mesh were found to be satisfactory for preparation of fluid, stable slurries containing 70% by weight of coal. Control of particle size distribution is required for maximum loadings and good rheological properties where viscosities should not exceed 30 poise for coal water mixtures between 60 and 100% minus 200 mesh. Viscosity is a strong function of dispersant type and content. Best dispersants are anionics in the class of sodium organosulfonates, e.g., Lomar-D and Tamol SN, which are both petrochemicals, and Marasperse CBOs-3, which is a sodium lignosulfonate (a wood derivative). Dispersant content required for fluidity ranges from a few tenths of a part per hundred of coal for a coal size consist of 60% minus 200 mesh to over one pphc for 100% minus 200 mesh. DOE

N83-17737# Oak Ridge National Lab, Tenn. Computer Sciences Div.

ECONOMIC INCENTIVES FOR ADDITIONAL CRITICAL EXPERIMENTATION APPLICABLE TO FUEL DISSOLUTION

J. F. MINCEY, R. T. PRIMM, III, and W. R. WALTZ (Allied-General Nuclear Services) 1981 6 p refs Presented at the Ann Winter Meeting of the Am Nucl Soc., San Francisco, 29 Nov. - 4 Dec 1981

(Contract W-7405-ENG-26)

(DE82-006818; CONF-811103-105) Avail: NTIS HC A02/MF A01

An economic scoping study is presented which demonstrates that additional critical experimentation will likely lead to reductions in the soluble absorber (i.e., gadolinium) purchase costs for dissolution operations. The results indicate that anticipated savings may be more than enough to pay for the experimental costs. DOE

N83-17739# Brigham Young Univ, Provo, Utah Dept. of Chemistry.

IDENTIFICATION AND MUTAGENICITY OF NITROGEN-CONTAINING POLYCYCLIC AROMATIC COMPOUNDS IN SYNTHETIC FUELS

D. W. LATER, M. L. LEE, R. A. PELROY (Pacific Northwest Lab), and B. W. WILSON (Pacific Northwest Lab) 1981 12 p refs Presented at the 6th Symp. on Polycyclic Aromatic Hydrocarbons, Columbus, Ohio, 27 Oct. 1981

(Contract DE-AC06-76RL-01830)

(DE82-006173; PNL-SA-10046, CONF-811086-5) Avail: NTIS HC A02/MF A01

The detailed characterization of synfuel products and byproducts can provide invaluable information relating to the environmental implications of synfuel production and the potential end uses of the products. This paper describes an effective analytical methodology for the separation and identification of nitrogen-containing polycyclic aromatic compound (N-PAC) in these materials, and the results obtained from mutagenicity assays of isolated fractions. Two solvent refined coal liquids were used for this study. Initial separation on neutral alumina was used to obtain an N-PAC fraction. Silicic acid adsorption chromatography was used to get separation of the N-PAC into three additional groups according to the functionality of the nitrogen heteroatom in the aromatic ring system. Then fraction 2 containing amino polycyclic aromatic hydrocarbons, APAH, was derivatized with pentafluoropropionic anhydride for further separation (ATT). DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-17741# California Univ., Livermore Lawrence Livermore Lab Liquefied Gaseous Fuels Program

FDAS HARDWARE AND FIRMWARE DESCRIPTION, LIQUEFIED GASEOUS FUELS (LGF) DATA-ACQUISITION SYSTEM

J BAKER Mar 1982 87 p

(Contract W-7405-ENG-48)

(DE82-012602, UCID-19348) Avail NTIS HC A05/MF A01

The FDAS are the front end data acquisition units of the liquefied gaseous fuels data acquisition system (LGF DAS). They acquired data from numerous sensors during liquefied natural gas (LNG) dispersion and vapor burn experiments. The hardware, functions, commands, messages, and firmware of the FDAS units are described. DOE

N83-17742# Los Alamos Scientific Lab., N. Mex.

METHANE HYDRATE GAS PRODUCTION: AN ASSESSMENT OF CONVENTIONAL PRODUCTION TECHNOLOGY AS APPLIED TO HYDRATE GAS RECOVERY

P. L. MCGUIRE Nov 1981 20 p refs

(Contract W-7405-ENG-36)

(DE82-006746, LA-9102-MS) Avail NTIS HC A02/MF A01

Two fairly straightforward thermal-stimulation models were developed to bracket the expected gas production from a methane hydrate reservoir. The frontal-sweep model represents the upper bound on hydrate gas production and the fracture-flow model represents the lower bound. Parametric studies were made with these two models to determine the importance of a number of variables, including porosity, bed thickness, injection temperature, and fracture length. A one-dimensional porous flow model was developed to approximate the hydrate gas production by pressure reduction from a hydraulically fractured well. Parametric studies were made with this decompression model to determine the importance of a number of variables, including porosity, initial formation temperature, bottomhole producing pressure, and the permeability in both the hydrated sediment and in the region in which the hydrate was dissociated. A fracture-stimulation technique suitable for this production method was developed. The salt-frac described should make the production of hydrate gas feasible even at temperatures well below 32 F. DOE

N83-17743# Pittsburgh and Midway Coal Mining Co., Englewood, Colo.

SOLVENT-REFINED-COAL (SRC) PROCESS Quarterly Technical Progress Report, Jan. - Mar. 1981

Nov 1981 448 p refs

(Contract DE-AC05-76ET-10104)

(DE82-010061, DOE/ET-10104/15) Avail. NTIS HC A19/MF A01

The progress of the Solvent Refined Coal (SRC) project by the Pittsburgh & Midway Coal Mining Co. under contract with the Department of Energy is summarized. Included are summaries of three areas of contract work: the SRC Pilot Plant at Fort Lewis, Washington; the Gulf Science and Technology Company Process Development Unit (P-99) in Harmarville, Pennsylvania; and Research and Development technical support services conducted at Harmarville. DOE

N83-17754# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho

DESIGN, CONSTRUCTION, OPERATION AND COSTS OF A MODERN SMALL-SCALE FUEL-ALCOHOL PLANT

S. A. LEEPER, L. J. DAWLEY, J. H. WOLFRAM, G. R. BERGLUND, J. G. RICHARDSON, and R. E. MCATEE Jan 1982 17 p refs. Presented at the 6th Ann Conf. on Energy from Biomass Wastes, Lake Buena Vista, Fla., 25-29 Jan 1982. Submitted for publication.

(Contract DE-AC07-76ID-01570)

(DE82-011019, GG-M-11781, CONF-820127-2) Avail NTIS HC A02/MF A01

The design used for the small-scale fuel alcohol plant (SSFAP) is discussed. By incorporating a microprocessor into the plant design, most plant operations were automated and labor requirements were reduced. Continuous processing made energy

conservation possible, thus reducing energy requirements. A low-temperature, continuous plug-flow cooker design made high yields possible. Ethanol was consistently produced at the SSFAP from corn at a yield of 2.6 gallons (anhydrous) per bushel and an energy requirement of 30,000 to 35,000 Btu/gallon (190-proof). In addition, barley, grain dust, and potato waste were converted at the SSFAP. The capacity of the SSFAP is 180,000 gallons per year (300 days operation). Competitively priced ethanol is produced at this capacity. DOE

N83-17765# Joint Publications Research Service, Arlington, Va. FIRST RESULTS, PROBLEMS OF FRENCH DEEP GASIFICATION PROGRAM

P. GAUSSENS *In its* West Europe Rept.: Sci and Technol., No 134 (JPRS-82686) p 49-61 20 Jan 1983 Transl into ENGLISH from L'Ind. du Pétrole Gaz-Chim. (France), Oct 1982 p 46-52

Avail: NTIS HC A05/MF A01

The development of a technology for the gasification of deep coal reserves that are technically and economically not exploitable by classic mining methods was investigated. The principal problem is the very low permeability of the deep coal which makes it necessary to create an artificial connection between the injection and production wells which is done by hydrofracturing method. The possibilities of an electrical connection are studied. Difficulties related to the spontaneous ignition of the coal and the creation of a backward combustion are revealed. Exploration of the factors that might limit the quality of the gas produced or the quantity of coal extracted by doublet is suggested which should lead to obtaining criteria for site selection. Knowledge of the natural conditions of a site is essential for the decision and the selection of the operating method. The characterization can be obtained by using exploration methods such as coring, logging, surface geophysics. EAK

N83-17852# Sandia Labs., Albuquerque, N. Mex. Energy Subsystems Div.

MASS FLOW OF CHAR/COAL IN OXYGEN-BLOWN ENTRAINED-BED GASIFIERS: AN ASSESSMENT OF INSTRUMENTS AND METHODS OF MEASUREMENT

J. G. CASTLE, JR. Dec 1981 28 p refs

(Contract DE-AC04-76DP-00789)

(DE82-006988, SAND-81-1820) Avail NTIS HC A03/MF A01

The mass flow in the feed lines of an entrained-bed gasifier is investigated. There are several promising techniques for the measurement of this mass flow. Four techniques that appear to be suitable for measuring mass flow in either coal or char feed lines are listed. A fifth, pulsed neutron activation, is included because of its potential as a calibration instrument. DOE

N83-17999# Research Inst. of National Defence, Stockholm (Sweden)

THE IMPORTANCE OF SATISFACTORY POSITIONING, DIVING AND MAPPING SYSTEMS, SUITABLE FOR EXPLORATION AND TRANSPORTATION IN ICE-COVERED SEA AREAS

R. THOREN 1982 66 p refs. Presented at Intern Soc for Photogrammetry and Remote Sensing (ISPRS) Intern Symp., Toulouse, 13-17 Sep 1982.

(FOA-B-60003-M7) Avail NTIS HC A04/MF A01

The evolution of remote sensing for operations in ice-covered sea areas, especially in the exploration of natural resources, such as oil, gas and minerals, and at surface shipping as well as under-ice navigation is reviewed. Expeditions and interdisciplinary scientific projects of special value for arctic operations are described. Underwater pingers, offshore permafrost and ground ice are discussed. Hydrooptics, hydroacoustics and navigation FOA-SUB (remote-controlled research vehicle), and diving activities and underwater communication are considered. Offshore activities and Scandinavian underwater technology are examined. A remotely-piloted vehicle employed for ship wreck reconnaissance in the High Arctic is described. Author

04 FUELS AND OTHER SOURCES OF ENERGY

N83-18005# Pacific Northwest Lab., Richland, Wash. **DESIGN OF HIGHWALL MINING EQUIPMENT ELECTRONIC GUIDANCE PACKAGE**

B B BRENDEN, G. P. MORGEN, and J. R. SKORPIK Nov. 1981 148 p

(Contract DE-AC06-76RL-01830)

(DE82-006115, PNL-4004) Avail NTIS HC A07/MF A01

Design specifics and guidance software are presented for a guidance system intended for use in guiding an auger type highwall mining head through thin coal seams to depths of up to 600 ft. A small desk top computer is used at the operator's station to send and receive signals in serialized bit streams to a downhole microprocessor. The guidance system accepts signals from a variety of sensors and uses these signals to plot and control the course of the auger head automatically using computer algorithms designed to keep the auger head in the coal seam and maintain a specified stump thickness. DOE

N83-18007# New York State Energy Research and Development Authority, New York.

PEAT-RESOURCE ESTIMATION IN NEW YORK STATE Quarterly Report, 1 Jul. - 31 Oct. 1981

J. M. PETERSON Dec 1981 12 p Sponsored in part by Gas Research Inst.

(Contract DE-FG01-81FE-05110)

(DE82-005156, DOE/FE-05110-T2; QR-2) Avail NTIS HC A02/MF A01

This report discusses progress made on the New York State peat inventory project as of October 1981. The principal objective is to determine the energy potential and distribution of peat resources in New York. The collection of existing data, identification of protected land, and standardization of mapping methods were addressed during this first year. DOE

N83-18008# Department of Energy, Laramie, Wyo. **SIMULATED IN SITU RETORTING OF OIL-SHALE IN A CONTROLLED-STATE RETORT. 3: DYNAMIC OIL FILM THICKNESS ON PARTIALLY RETORTED AND UNRETORTED SHALE**

J. J. DUVALL Feb. 1982 51 p refs

(DE82-011107, DOE/LC-RI-82-2-PT-3) Avail: NTIS HC A04/MF A01

The amount of oil washed from the partially retorted and unretorted shales from 14 interrupted runs of the controlled-state retort was used to estimate dynamic oil film thickness on those shales. The data obtained indicate that factors that affect oil viscosity determine oil film thickness. In the heated region of the retort, temperature was the controlling factor for oil film thickness. In the unheated region, controlling factors included proximity to the heated region, gas composition and flow rate, retorting advance rate, and breadth of retorting zone. Factors that affected oil composition and thereby increased viscosity, such as increased gas velocity, oxygen in the retorting gas, slower retorting advance rate, and thinner retorting zone, increased oil film thickness. In the unheated region of the retort, the oil film was thickest nearest the heated region gradually tapering to a more or less constant value approximately 1 meter from the heated region. Oil shale particle size did not affect oil film thickness. DOE

N83-18009# Battelle Pacific Northwest Labs., Richland, Wash. **WESTERN OIL-SHALE DEVELOPMENT, A TECHNOLOGY ASSESSMENT. VOLUME 6: OIL-SHALE DEVELOPMENT IN THE PICEANCE CREEK BASIN AND POTENTIAL WATER-QUALITY CHANGES**

Jan 1982 22 p refs

(Contract DE-AC06-76RL-01830)

(DE82-005659, PNL-3830-VOL-6, ANL/EES-TM-161-VOL-6)

Avail NTIS HC A02/MF A01

The stream quality changes due to premining pumping activities required to prepare oil shale lease Tracts C-a and C-b for modified in situ retorting are bracketed by assuming all premining pumping is discharged to the surface stream. In one case, the pumped water is assumed to be of a quality like that of the upper aquifer

with a relatively high quality. In the second case, the pumped water is assumed to come from the lower aquifer. Complete mixing and conservation of pollutants was assumed at sample points at the White River and at Lees Ferry of the Colorado River. Possible secondary effects of oil shale and coal mining are discussed. The uncertainties associated with the assumptions used and alternative uses for the water to prevent stream contamination by oil shale development are also considered. DOE

N83-18010# Los Alamos Scientific Lab., N. Mex.

RECOVERY OF MINERALS FROM US COALS

N. E. VANDERBORGH 1982 17 p refs Presented at the Process Mineral. Symp. of the 111th AIME Ann. Meeting, Dallas, 15-18 Feb. 1982

(Contract W-7405-ENG-36)

(DE82-008173, LA-UR-82-452; CONF-820205-2) Avail NTIS HC A02/MF A01

Projections show that domestic coal will serve for the majority of energy supplies during the next decades. Thorough chemical cleaning of this coal can be accomplished in long residence time, slurry transport systems to produce high quality fuel product. Concurrently, mineral recovery from coals will supplement existing ores. This concept is described and given preliminary engineering considerations for mineral recovery during transport operations. DOE

N83-18013# Weed (Thurlow) and Associates, Inc., Columbus, Ohio.

DEVONIAN SHALE EXTRACTION TEST WELLS

T. WEED and P. J. HENRY 30 Nov. 1981 200 p

(Contract DE-AC21-78MC-08386)

(DOE/MC-08386/T1) Avail. NTIS HC A09/MF A01

The results of four types of work performed in four Devonian Shale gas wells in one geology domain geographically located in central Ohio are discussed. It was demonstrated that Devonian age shales can be made to produce natural gas in the shallower one thousand foot depth range which is encountered over such wide areas of the Appalachian, Illinois and Michigan basins. New exploration rationales for locating fractured, or other highly productive reservoirs are discussed. State-of-the-art and advanced logging and stimulation techniques in relation to the geological, stress and reservoir conditions in the Project area are discussed. The economics of the various exploration and stimulation techniques tested are evaluated. DOE

N83-18014# Los Alamos Scientific Lab., N. Mex.

FRACTIONATION OF AN OIL SHALE RETORT PROCESS WATER: ISOLATION OF PHOTOACTIVE GENOTOXIC COMPONENTS

G. F. STRNISTE, J. M. BINGHAM, W. D. SPALL, J. W. NICKOLS, R. T. OKINAKA, and D. J. C. CHEN 1982 14 p refs Presented at the Symp. on the Appl. of Short-Term Bioassays in the Anal. of Complex Environ. Mixtures, Chapel Hill, N. C., 25-27 Jan. 1982. Submitted for publication

(Contract W-7405-ENG-36)

(DE82-010428, LA-UR-82-1272, CONF-820122-2) Avail. NTIS HC A02/MF A01

Attempts to fractionate and to chemically identify photoactive, genotoxic components in a particularly bioactive oil shale retort process water are reported. Fractionated water samples were assessed for mutagenic potential using the Salmonella histidine reversion assay with microsomal activation. The photoactive fractions of the process water were analyzed to define their chemical composition. Several classes of chemical compounds, including alkylated aromatic hydrocarbons, aromatic amines, aldehydes, amides and ketones are prevalent and it is suggested that they contribute to the photo induced genotoxic potential of this oil shale retort process water. DOE

N83-18015# Pacific Northwest Lab, Richland, Wash. Technology Assessments Div

WESTERN OIL SHALE DEVELOPMENT: A TECHNOLOGY ASSESSMENT. VOLUME 8. HEALTH EFFECTS OF OIL SHALE DEVELOPMENT Final Report

G. J. ROTARIU Feb 1982 45 p refs 8 Vol.

(Contract DE-AC06-76RL-01830)

(DE82-008695, PNL-3830-VOL-8, LA-UR-81-1785) Avail: NTIS HC A03/MF A01

Information on the potential health effects of a developing oil shale industry is given. The industry should be alert to the incidence of skin disease in the industrial setting. However, automated techniques, modern industrial hygiene practices and realistic personal hygiene should greatly reduce the hazards associated with skin contact. The entire question of regional water contamination and any resultant health hazard has not been adequately addressed. The industrial practice of hydrotreating the crude shale oil will diminish the carcinogenic hazard of the product. However, the quantitative reduction of biological activity is dependent on the degree of hydrotreatment. Both Soviet and American experimentalists demonstrated a correlation between carcinogenicity/toxicity and retorting temperature; the higher temperatures producing the more carcinogenic or toxic products.

DOE

N83-18016# Oak Ridge National Lab, Tenn. Chemical Technology Div.

METAL RECOVERY FROM EASTERN OIL SHALE

T. M. GILLIAM, R. M. CANON, A. D. RYON, and J. S. WATSON 1981 13 p refs. Presented at the Eastern Oil Shale Symp., Lexington, Ky., 15-17 Nov 1981

(Contract W-7405-ENG-26)

(DE82-004052, CONF-811169-1-DRAFT) Avail: NTIS HC A02/MF A01

Results are shown for the acid extractability of several minerals from (1) raw shale, (2) shale that has been retorted with hydrogen under pressure, and (3) retort residue that has been subjected to an oxidative roast. Six elements (Al, Co, Fe, Mo, U, and V) were identified as having the greatest probability for economical recovery. Conceptual process flowsheets for their recovery are presented.

DOE

N83-18029# Institute of Geological Sciences, London (England). Geophysics and Hydrogeology Div

INVESTIGATION OF THE GEOTHERMAL POTENTIAL OF THE UK. THE SOUTHAMPTON (WESTERN ESPLANADE) GEOTHERMAL WELL: A PRELIMINARY ASSESSMENT OF THE RESOURCE

R. A. DOWNING, D. J. ALLEN, W. G. BURGESS, I. E. SMITH, and W. M. EDMUNDS 10 May 1982 67 p refs. Sponsored by Dept. of Energy, Southampton City Council and EEC. Avail: NTIS HC A04/MF A01

The Southampton No 1 (Western Esplanade) geothermal well which was drilled for the development of hot brines in the Triassic sandstones was tested. The aquifer was intersected at a depth of 1729 m. The upper 24 m contained thin, medium to coarse grained sandstones which are the main water bearing horizons. The static water level is about 80 m below ground level. Gas lifting with nitrogen indicate that the sandstones contain a brine with a salinity of 125 g/l at a temperature of 76 deg C. The maximum yield of the well was 30 l/s for a pressure reduction of 4.2 MN/sq m. The transmissivity of the aquifer is about 5 Dm. A hydraulic barrier, probably a fault, occurs close to the well.

E A K

N83-18031# Gewerkschaft Sophia-Jacoba, Hueckelhoven (West Germany). Steinkohlenbergwerk.

CONSTRUCTION AND OPERATION OF A CENTRAL HEATING PLANT PROTOTYPE HEATED BY COAL DUST CORRESPONDING TO THE SCHOPPE SYSTEM Final Report, Aug. 1981

W. WENZ Bonn Bundesministerium fuer Forschung und Technologie Nov 1982 121 p refs. In GERMAN; ENGLISH summary. Sponsored by Bundesministerium fuer Forschung und Technologie.

(BMFT-FB-T-82-176; ISSN-0340-7608) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25,50

Fluidized fired boiler plants in central heating systems are an alternative to oil and gas fired plants in economical and technical respect. Fluidized is the name of a fuel from coal dust. In more than 2 700 running hours the heat and service water consumption of the coop building was covered by this pulverized fuel fired heating plant with a capacity of 2,5 GJ/h without any problems. Each installation of the plant, from fuel supply to ash removal, is examined and improved.

E.A.K.

N83-18032# Karlsruhe Univ. (West Germany). Lehrstuhl fuer Chemik und Technik.

EXTRACTION OF COAL WITH SOLVENTS IN LIQUID AND SUPERCRITICAL STATE UNDER NONHYDROGENATING AND HYDROGENATING CONDITIONS Final Report, May 1982

A. WILHELM and K. HEDDEN Bonn Bundesministerium fuer Forschung und Technologie Oct. 1982 228 p refs. In GERMAN; ENGLISH summary. Sponsored by Bundesministerium fuer Forschung und Technologie.

(BMFT-FB-T-82-177; ISSN-0340-7608) Avail: NTIS HC A11/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 39

The basic steps of coal extraction to determine the optimum conditions for obtaining a higher coal conversion yield in a technical process of supercritical coal extraction were examined. A fixed bed of coal was slowly heated up in a current of pressurized solvent by a nonisothermal technique. The solvent changes its physical state during extraction from a liquid to a supercritical fluid. The formation rates of extract and gaseous products and their integral yields were measured under different extraction conditions. Various coals and lignites as well as different solvents including H-donor solvents and the effect of the addition of molecular hydrogen to the supercritical phase with and without catalyst were studied. Results are interpreted with an extraction scheme, comprising chemical reactions; phase equilibria and transport processes as single steps of the complex extraction procedure. Using a simplified mathematical model, the formation rates of extract as a function of temperature were quantitatively described with effective kinetic parameters. New process for the hydrogenating supercritical extraction of coal, which produces high coal conversion yields is proposed.

E A K.

N83-18034# Chemische Werke, Huels (West Germany)

PRE-FEASIBILITY STUDY FOR CONSTRUCTION OF A COMMERCIAL COAL HYDROGENATION PLANT Final Report, Mar. 1982

W. HAHN, H. WILHELM, H. KLEINHUECKELKOTTEN (VEBA OEL AG), and B. SCHMEDESHAGEN (VEBA OEL AG) Bonn Bundesministerium fuer Forschung und Technologie Nov 1982 125 p. In GERMAN; ENGLISH summary. Sponsored by Bundesministerium fuer Forschung und Technologie.

(BMFT-FB-T-82-190, ISSN-0340-7608) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 26

The technical problems, a suitable site and the unsatisfactory economics hinder the realization of a commercial coal liquefaction plant in Germany were identified. It is found that a plant for hydrogenation of coal and heavy oil according to the updated bergius-Pier process can be built. The improvement of acceptable reactor loading and increase of product yield was considered. The infrastructure aspects of a site for the plant which covers 300 hectares as well as eventually existing atmospheric pollution conditions in the environment are also considered.

E A K

04 FUELS AND OTHER SOURCES OF ENERGY

N83-18047# Pacific Northwest Lab., Richland, Wash.
PACIFIC NORTHWEST BIOMASS AS AN ENERGY RESOURCE
A. D. CHOCKIE Nov. 1981 13 p refs Presented at the 4th Inter. Conf. on Alternative Energy Sources, Miami Beach, Fla., 14 Dec. 1981

(Contract DE-AC06-76RL-01830)
(DE82-005804, PNL-SA-9982; CONF-811212-11) Avail: NTIS HC A02/MF A01

A review of the biomass resource base in the Northwest scenarios and a preliminary analysis of the issues involved in the collection and use of forest residues as an energy resource are presented. DOE

N83-18052# Atlas Corp., Santa Cruz, Calif.
PROCEEDINGS OF THE FIFTH ANNUAL GEOTHERMAL CONFERENCE AND WORKSHOP

Nov. 1981 292 p refs Conf. held in San Diego, Calif., 23-25 Jun. 1981 Sponsored by EPRI
(Contract EPRI PROJ. WS-81-197)
(DE82-901295; EPRI-AP-2098; CONF-8106135) Avail: NTIS HC A13/MF A01

Various aspects of geothermal energy utilization are discussed. Geysers, turbines, and steam are discussed. Pilot plant operations are assessed. Economic strategies are considered. DOE

N83-18057# Pacific Northwest Lab., Richland, Wash.
CATALYST BEHAVIOR IN BIOMASS GASIFICATION
S. L. WEBER, L. J. SEALOCK, JR., L. K. MUDGE, D. H. MITCHELL, and R. J. ROBERTUS 1981 31 p refs Presented at the 90th AIChE Natl. Meeting, Houston, Tex., 5-9 Apr. 1981
(Contract DE-AC06-76RL-01830)
(DE82-006164, PNL-SA-9063; CONF-810417-10) Avail: NTIS HC A03/MF A01

Conversion of biomass to specific products by steam gasification in the presence of catalysts is the subject of investigations conducted to determine the technical feasibility of catalytic processes for wood gasification to specific products and to evaluate the economic feasibility of the technically feasible processes. Studies focused on producing a methane rich gas and a 2:1 H₂ to CO ratio synthesis gas suitable for hydrocarbon or methanol production via conventional methods. Specific catalysts employed and their behavior for each gasification scheme are discussed. DOE

N83-18058# Pacific Northwest Lab., Richland, Wash.
CATALYTIC GASIFICATION OF BIOMASS
R. J. ROBERTUS, L. K. MUDGE, L. J. SEALOCK, JR., D. H. MITCHELL, and S. L. WEBER 1981 26 p refs Presented at the Spring Meeting of the Western States Sect. of the Combustion Inst., Pullman, Wash., 13-14 Apr. 1981
(Contract DE-AC06-76RL-01830)
(DE82-005877; PNL-SA-9173, CONF-810466-4) Avail: NTIS HC A03/MF A01

Methane and methanol synthesis gas can be produced by steam gasification of biomass in the presence of appropriate catalysts. This concept is to use catalysts in a fluidized bed reactor which is heated indirectly. The objective is to determine the technical and economic feasibility of the concept. Technically the concept has been demonstrated on a 50 lb per hr scale. Potential advantages over conventional processes include no oxygen plant is needed, little tar is produced so gas and water treatment are simplified, and yields and efficiencies are greater than obtained by conventional gasification. Economic studies for a plant processing 2000 T/per day dry wood show that the cost of methanol from wood by catalytic gasification is competitive with the current price of methanol. Similar studies show the cost of methane from wood is competitive with projected future costs of synthetic natural gas. When the plant capacity is decreased to 200 T per day dry wood, neither product is very attractive in today's market. DOE

N83-18061# Brookhaven National Lab., Upton, N. Y. Biomedical and Environmental Assessment Div.

MODEL SIMPLIFICATION TO EXAMINE THE INTERRELATIONSHIPS BETWEEN COAL, GAS AND OIL USE

H. C. THODE, JR., A. S. KYDES, and S. J. FINCH 1981 21 p refs Presented at the CORS-TIMS-ORSA Joint Natl. Meeting, Toronto, Canada, 3-6 May 1981

(Contract DE-AC02-76CH-00016)
(DE82-007816, BNL-30741; CONF-810542-6) Avail: NTIS HC A02/MF A01

The Brookhaven Energy System Optimization Model (BESOM) is used to develop a simplified model for investigating the inter-relationships between coal, gas, and imported oil use in the USA using the pseudo-data approach and exploratory data analysis. This simplified model is tested by predicting the imported oil needed for levels of coal and gas use consistent with the restrictions of BESOM. Predictions of the derived functions were verified with full-scale BESOM runs. DOE

N83-18066# Lahontan, Inc., Sacramento, Calif. Alternate Energy Systems Dept.

GEOTHERMAL ENERGY: OPPORTUNITIES FOR CALIFORNIA COMMERCE, PHASE 1 REPORT

P. KLAUSSEN and P. EDWARDES Jan. 1982 117 p refs Sponsored in part by the California Energy Commission
(Contract DE-FC03-79ET-27135)

(DE82-009121, DOE/ET-27135/T1) Avail: NTIS HC A06/MF A01

California's geographic and end use markets which could directly use low and moderate temperature geothermal resources are ranked and described, as well as those which have the highest potential for near term commercial development of these resources. Out of 38 geothermal resource areas with characteristics for direct use development, five areas have no perceived impediments to near term development. Twenty-nine applications were compared with previously selected criteria to determine their near term potential for direct use of geothermal fluids. Seven categories were found to have the least impediments to development, agriculture and district heating applications are considered the highest. Ten year projections were conducted for fossil fuel displacement from the higher rated applications. It is concluded that greenhouses have the greatest displacement of 18 x 10 to the 6th power therms per year. DOE

N83-18070# Gruy Federal, Inc., Arlington, Va.
MULTIPLE-TASK SERVICES FOR THE DIVISION OF GEOTHERMAL ENERGY'S HYDROTHERMAL-RESOURCES PROGRAM Annual Report, Nov. 1980 - Oct. 1981

Jan. 1982 17 p
(Contract DE-AC08-81NV-10177)
(DE82-009007, DOE/NV-10177/1) Avail: NTIS HC A02/MF A01

Activities and tasks regarding geothermal resources are listed. The tasks involve resource definition and technical assistance. DOE

N83-18073# Geological Survey, Denver, Colo.
GEOTHERMAL RESOURCE ASSESSMENT OF IDAHO SPRINGS, COLORADO. RESOURCE SERIES 16

F. N. REPPLIER, T. G. ZACHARAKIS, and C. D. RINGROSE 1982 56 p refs
(Contract DE-AS07-77ET-28365)

(DE83-000345; DOE/ET-28365/17) Avail: NTIS HC A04/MF A01

Geothermal springs and wells were assessed for hydrothermal conditions. The temperature of these waters ranges from a low of 680 F to a high of 1270 F. The hydrothermal conditions of the Idaho Springs region in 1980 were defined by electrical geophysical, soil mercury geochemical, and reconnaissance geological and hydrogeological surveys. The investigation was limited to the immediate area surrounding the thermal springs at the Indian Springs Resort. It is found that bedrock of the region is faulted and fractured metamorphosed Precambrian gneisses and schists,

04 FUELS AND OTHER SOURCES OF ENERGY

locally intruded by Tertiary age plutons and dikes. It is shown that the thermal waters most likely are fault controlled and the thermal area does not have a large areal extent. DOE

N83-18075# Argonne National Lab., Ill. Energy from Municipal Waste Program.

METHANE FROM LANDFILLS: PRELIMINARY ASSESSMENT WORKBOOK

M L WILKEY, R E ZIMMERMAN, and H. R ISAACSON (ESCOR, Inc) Jun 1982 30 p

(Contract W-31-109-ENG-38)

(DE83-002319, ANL/CNSV-31) Avail NTIS HC A03/MF A01

System options for developing landfill gas recovery projects are discussed. Factors effecting the economics of each option are reported. Sample calculations and worksheets are included to assist in the process of making preliminary judgments about production and revenue potentials for landfill gas recovery at a specific site. DOE

N83-18078# Sandia Labs., Albuquerque, N Mex.

PROJECT DEEP STEAM Quarterly Report, 1 Jan. - 31 Mar. 1981

D P AESCHLIMAN, R G. CLAY, A. B DONALDSON, S W EISENHAWER, R L. FOX, D R JOHNSON, and A J MULAC Jan 1982 22 p

(Contract DE-AC04-76DP-00789)

(DE82-010945, SAND-81-2203) Avail NTIS HC A02/MF A01

The objective of Project DEEP STEAM is to develop the technology to economically produce heavy oils from deep reservoirs. The tasks included in this project are the development of thermally efficient delivery systems and downhole steam generation systems. During the period January 1-March 31, 1981, effort has continued on a low pressure combustion downhole generator (Rocketdyne), and on two high pressure designs (Foster-Miller Associates, Sandia National Laboratories). The Sandia design was prepared for deployment in the Wilmington Field at Long Beach, California. Progress continued on the Min-Stress II packer concept at L'Garde, Inc., and on the extruded metal packer at Foster-Miller. Initial bare string field data are reported on the insulated tubular test at Lloydminster, Saskatchewan, Canada. DOE

N83-18082# Oak Ridge National Lab., Tenn.

FOSSIL ENERGY PROGRAM Progress Report, Oct. 1981

L E MCNEESE Dec 1981 95 p refs

(Contract W-7405-ENG-26)

(DE82-007496, ORNL/TM-8116) Avail NTIS HC A05/MF A01

Research and development programs in support of the increased utilization of coal and other fossil fuel alternatives as sources of clean energy are reported. The following projects are reported: coal conversion development, chemical research and development, materials technology, component development and process evaluation, technical support to major liquefaction, process analysis and engineering evaluations, fossil energy environmental analysis, environmental control technology, coal preparation waste utilization, atmospheric fluidized bed coal combustor for cogeneration, TVA FBC demonstration plant program technical support, PFBC systems analysis, FBC char utilization improvement, fossil fuel applications assessments, performance assurance system support for fossil energy projects, international energy technology, generalized equilibrium models for liquid and gaseous fuel supplies, analysis of coal production, and fossil energy information center. DOE

N83-18083# Oak Ridge National Lab., Tenn.

FOSSIL-ENERGY PROGRAM Progress Report, Nov. 1981

L E MCNEESE Jan 1982 91 p

(Contract W-7405-ENG-26)

(DE82-007502, ORNL/TM-8153) Avail NTIS HC A05/MF A01

The increased utilization of coal and other fossil fuel alternatives as sources of clean energy is reported. The projects reported include coal conversion development, chemical research and development, materials technology, component development and

process evaluation, technical support to major liquefaction, process analysis and engineering evaluations, fossil energy environmental analysis, environmental control technology, coal preparation waste utilization, atmospheric fluidized bed coal combustor for cogeneration, TVA FBC demonstration plant program technical support, PFBC systems analysis, FBC char utilization improvement, fossil fuel applications assessments, performance assurance system support for fossil energy projects, international energy technology, generalized equilibrium models for liquid and gaseous fuel supplies, instrumentations and controls and fossil energy information center. DOE

N83-18085# Oak Ridge National Lab., Tenn.

ADVANCED RESEARCH AND TECHNOLOGY DEVELOPMENT FOSSIL ENERGY MATERIALS PROGRAM Quarterly Progress Report for period ending 30 Sep. 1981

R A BRADLEY, comp Dec. 1981 411 p refs

(Contract W-7405-ENG-26)

(DE82-007121; ORNL/FMP-81-4; QPR-4) Avail NTIS HC

A18/MF A01

Research and development on materials for fossil energy applications with a focus on the longer-term and generic needs of the various fossil fuel technologies is discussed. Research aimed toward a better understanding of materials behavior in fossil energy environments and the development of new materials capable of substantial enhancement of plant operations and reliability is discussed. Coal gasification, coal liquefaction, pressure vessel materials, and heat exchangers are discussed. DOE

N83-18101# New Jersey Inst of Tech., Newark.

LEACHATE-TREATMENT TECHNIQUE UTILIZING FLY ASH AS LOW-COST SORBENT Quarterly Progress Report

J W LISKOWITZ, J. GROW, M. SHEIH, R TRATTNER, J KOHUT (Public Service Electric and Gas Co.), and M. ZWILLENBERG (Public Service Electric and Gas Co.) 1982 46 p

(Contract DE-FG22-80PC-30231)

(DE82-010501; DOE/PC-30231/3) Avail NTIS HC A03/MF

A01

Twelve different coals were burned in three different types of boilers to determine the influence of coal composition, ash fusion temperatures, boiler additives, combustion conditions and co-firing of natural gas or oil with the coal, on the composition of the fly ash and bottom ash as well as the leaching and sorbate characteristics of the fly ash produced. The trace element analysis in the twelve coals and their respective fly and bottom ashes as well as surface analysis of a selected number of fly ashes using ESCA is reported. The leaching characteristics of the fly ashes with respect to pH were defined for several trace elements: Leaching of Cd, B, Sn, Ni, Pb, Mo, Cu, Cr, Zn, Mn and Fe was found to be directly proportional to (1) the amount of these trace elements present; (2) decreases in pH; (3) decreases in boiler temperatures; and (4) increases in ash fusion temperatures. Fly ash particles which leached the least amount of the above elements exhibited the best sorbate characteristics. DOE

N83-18123# Technische Hochschule, Karlsruhe (West Germany) Inst. fuer Petrographie und Geochemie.

APPLICATION OF ENERGY DISPERSIVE X-RAY FLUORESCENCE, ION SENSITIVE ELECTRODES AND INSTRUMENTAL NEUTRON ACTIVATION IN GEOCHEMICAL PROSPECTING Final Report, Sep. 1981

U. KRAMAR, J. NORBERT, and H. PUCHELT Bonn Bundesministerium fuer Forschung und Technologie Sep 1982 76 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie (BMFT-FB-T-82-152, ISSN-0340-7608) Avail NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 16

Extraction methods were tested for their suitability in geochemical prospecting for fluore in stream sediments. The most common fluorine bearing minerals were treated with different extractants and the most favorable conditions for the determination of fluorine by ionsensitive electrodes were determined. Radionuclide fluorescence analysis with semiconductor detector

04 FUELS AND OTHER SOURCES OF ENERGY

and online data handling is a method for simultaneous multielement determinations applicable for different kinds of samples as soils, stream sediment and rocks. Measuring parameters, like sample geometry, conditions for the excitation of the characteristic X-rays, measuring time and grain size were optimized for a high output and simplest sample pretreatment. Both methods, F-analysis by ionsensitive electrodes and radionuclide X-ray fluorescence analysis were used for a reconnaissance stream sediment survey. E.A.K.

N83-18137# Department of Energy, Laramie, Wyo Energy Technology Center

HIGH RESOLUTION SEISMIC SURVEY OF THE HANNA, WYOMING UNDERGROUND COAL GASIFICATION AREA

A. D. YOUNGBERG, E BERKMAN (Emerald Exploration Consultants, Inc.), and A ORANGE (Emerald Exploration Consultants, Inc.) Jan. 1982 49 p refs (DE82-006887; DOE/LC-RI-82/1) Avail: NTIS HC A03/MF A01

In November 1980 a high resolution seismic survey was conducted at the underground coal gasification test site near Hanna, Wyoming. The objectives of the survey were to determine the feasibility of utilizing high resolution seismic technology to locate and characterize underground coal burn zones and to identify shallow geologic faults at the test site. Seismic data acquisition and processing parameters were specifically designed to emphasize reflections at the shallow, 61 to 91 meter (200 to 300 foot) depths of interest. An anomaly was clearly discernable resulting from the rubble-collapse void above the burn zone which was studied in detail and compared to synthetic models. It is felt that the seismic method can be used to define similar burns.

DOE

N83-18138# Illinois State Geological Survey, Champaign Dept of Energy and Natural Resources.

PERSPECTIVES IN GEOLOGY: INVITED PAPERS PRESENTED AT A SYMPOSIUM IN OBSERVANCE OF THE 75TH ANNIVERSARY OF THE ILLINOIS STATE GEOLOGICAL SURVEY

1982 70 p refs Symp. held in Champaign, Ill., 9-10 Oct. 1980 Prepared for Illinois Inst. of Natural Resources, Springfield (PB-255589; IL/SGS/CIRC-525) Avail: NTIS HC A04/MF A01 CSCL 08G

Perspectives in geology, mineral resources, paleontology, and environmental concerns are presented. Coal geology and petroleum exploration are discussed. Groundwater, nonfuel minerals, and engineering geology are considered. The radioactive waste storage in mined caverns is also discussed.

N83-18139# Illinois State Geological Survey, Champaign. **THE ILLINOIS STATE GEOLOGICAL SURVEY. THE NEXT QUARTER CENTURY**

J. A. SIMON *In its* Perspectives in Geol p 1-6 1982 Avail: NTIS HC A04/MF A01 CSCL 08G

A history of survey programs is presented. Underground storage, toxic waste disposal, land use planning, coal mining, oil and gas exploration, mineral exploration, and geologic hazards are discussed in relation to geologic research. S.L.

N83-18140# Exxon Production Research Company, Houston, Tex.

COAL GEOLOGY. WHO NEEDS IT?

H J. GLUSKOTER *In* Illinois State Geological Survey Perspectives in Geol. p 7-11 1982 refs

Avail: NTIS HC A04/MF A01 CSCL 08G

Geological research is discussed in relation to coal and coal mining. Geophysical and logging techniques used in coal exploration and evaluation are reviewed. S.L.

N83-18141# Geological Survey, Washington, D C

US PETROLEUM EXPLORATION. LIKELY TARGETS 1980 - 2000

R. F. MAST *In* Illinois State Geological Survey Perspectives in Geol p 13-18 1982 refs Avail: NTIS HC A04/MF A01 CSCL 08G

Methods of estimating the quantities of undiscovered oil and gas contained in petroleum basins are discussed. Areas of oil and gas exploration are considered. S.L.

N83-18143# Library of Congress, Washington, D C

PERSPECTIVES IN NON-FUEL MINERALS

A. F. AGNEW *In* Illinois State Geological Survey Perspectives in Geol p 25-31 1982 refs

Avail: NTIS HC A04/MF A01 CSCL 08G

Mineral exploration and utilization are discussed. Problems associated with metallic and nonmetallic minerals, and the significance of these problems are considered. S.L.

N83-18325# Massachusetts Inst of Tech., Cambridge. Energy Lab.

ASPEN TECHNICAL REFERENCE MANUAL

May 1982 527 p refs

(Contract DE-AC21-81MC-16481)

(DE82-020201; DOE/MC-16481/1202-VOL-2) Avail: NTIS HC A23/MF A01

ASPEN (Advanced System for Process Engineering) is a software system for computer-aided process design. ASPEN was developed at M.I.T. during the period 1976-1981 under the sponsorship of the Department of Energy and 55 industrial participants. There are four manuals and one computer tape describing the maintenance, use, and installation of ASPEN. The ASPEN Technical Reference Manual is a two volume manual containing detailed technical descriptions of ASPEN unit operation models, physical property models, cost models, convergence methods, and the flowsheet analysis algorithm. It is intended solely as a reference manual for ASPEN support staff and advanced users. It is not necessary for the average user to have this manual in order to use ASPEN. DOE

N83-18326# Massachusetts Inst of Tech., Cambridge. Energy Lab.

ASPEN TECHNICAL REFERENCE MANUAL

May 1982 530 p 2 Vol

(Contract DE-AC21-81MC-16481)

(DE82-020200; DOE/MC-16481/1202-VOL-1) Avail: NTIS HC A23/MF A01

ASPEN (Advanced System for Process Engineering) is a software system for computer-aided process design. ASPEN was developed at M.I.T. during the period 1976-1981 under the sponsorship of the Department of Energy and 55 industrial participants. There are four manuals and one computer tape describing the maintenance, use, and installation of ASPEN. The ASPEN Technical Reference Manual is a two volume manual containing detailed technical descriptions of ASPEN unit operation models, physical property models, cost models, convergence methods, and the flowsheet analysis algorithm. It is intended solely as a reference manual for ASPEN support staff and advanced users. It is not necessary for the average user to have this manual in order to use ASPEN. GRA

N83-18327# Massachusetts Inst of Tech., Cambridge. Energy Lab.

ASPEN SYSTEM ADMINISTRATOR MANUAL

May 1982 647 p 2 Vol

(Contract DE-AC21-81MC-16481)

(DE82-022199; DOE/MC-16481/1201-VOL-2) Avail: NTIS HC A99/MF A01

Advanced System for Process Engineering (ASPEN) is a software system for computer aided process design. System maintenance and updating procedures and documentation of the ASPEN program code are given. The manual is intended to serve as a reference manual and a maintenance manual for ASPEN.

04 FUELS AND OTHER SOURCES OF ENERGY

support staff and as a programmer's guide for anyone writing a new model. DOE

N83-18328# Massachusetts Inst of Tech, Cambridge. Energy Lab.

ASPEN SYSTEM ADMINISTRATOR MANUAL

May 1982 729 p refs 2 Vol
(Contract DE-AC21-81MC-16481)
(DE82-020198, DOE/MC-16481/1201-VOL-1) Avail. NTIS HC A99/MF A01

Advanced System for Process Engineering (ASPEN) is a software system for computer aided process design. System maintenance and updating procedures and documentation of the ASPEN program code are given. The System Administrator Manual is intended to serve as a reference manual and a maintenance manual for ASPEN support staff and as a programmer's guide for anyone writing a new model. DOE

N83-18329# Massachusetts Inst. of Tech., Cambridge. Energy Lab.

ASPEN USER MANUAL

May 1982 720 p 2 Vol.
(Contract DE-AC21-81MC-16481)
(DE82-020196; DOE/MC-16481/1203-VOL-1) Avail. NTIS HC A99/MF A01

Advanced System for Process Engineering (ASPEN) is a software system for computer aided process design. The ASPEN User Manual is a two volume manual describing how to use ASPEN. It is intended to serve both as a reference manual for users familiar with ASPEN and as a tutorial manual for the beginning user. The User Manual contains all the information needed to create an ASPEN file. It does not describe how to make an ASPEN run. Additional manuals and publications are discussed. DOE

N83-18416# Energy and Minerals Research Co., Exton, Pa

ULTRASONICALLY ENHANCED SIZE REDUCTION OF COAL Quarterly Technical Progress Report, 26 Sep. - 25 Dec. 1981

W. B. TARPLEY, JR., H. M. STEPHEY, and S. R. TAYLOR Jan 1982 12 p
(Contract DE-AC22-81PC-42268)
(DE82-008679; DOE/PC-42268/T2, QTPR-2) Avail. NTIS HC A02/MF A01

Preliminary work in ultrasonic grinding of coal over a broad range of feed stock and final product has been very promising. The beneficial effects of an ultrasonic assist to the grinding procedure include rapid cyclic promotion of fatigue crack growth (10,000 to 50,000 cycles per second); preferential delivery of energy to discontinuities, reduction of particulate shielding by deagglomeration; promotion of stress corrosion cracking with grinding aids (as in moist grinding), cavitation grinding in a moist environment, and preferential shear. This work is expected to demonstrate the beneficial effects of ultrasonic coal comminution on a controlled laboratory scale, to evaluate grinding selectivity, and to obtain a preliminary estimate of the power required. DOE

N83-18464# Sandia Labs, Albuquerque, N. Mex
EXPERIENCE IN TESTING OF A SOLUTION MINED STORAGE CAVERN

K. L. GOIN 1982 23 p. Presented at the 61st Ann. Convention of the Gas Processors Assoc., Dallas, 15-17 Mar. 1982
(Contract DE-AC04-76DP-00789)
(DE82-011013; SAND-82-0522C, CONF-820323-1) Avail. NTIS HC A02/MF A01

Recertification tests were made of the strategic petroleum reserve oil storage cavern number. The cavern has a volume of 8,600,000 barrels. Tests included hydrostatic tests of the brine filled cavern and nitrogen leak tests of the three wells entering the cavern. Test procedures are described and test results are discussed. DOE

N83-18554# Woodard-Clyde Consultants, San Francisco, Calif
DECISION FRAMEWORK FOR TECHNOLOGY CHOICE. VOLUME 1. A CASE STUDY OF ONE UTILITY'S COAL-NUCLEAR CHOICE

R. L. KEENEY, J. R. BELEY, P. FLEISCHAUER, C. W. KIRKWOOD, and A. SICHerman Dec 1981 247 p refs 2 Vol
(Contract EPRI PROJ 1433-1)
(DE82-902213, EPRI-EA-2153-VOL-1) Avail. NTIS HC A11/MF A01

A method designed to assist the utility industry in making technology choices in a logically consistent manner is presented. The result evaluation model is based on the principles of decision analysis. The evaluation model and its components are discussed and its application is demonstrated using a coal nuclear choice. The case study is only meant to be illustrative and its purpose is to demonstrate the methodology. DOE

N83-18875# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

ENTRAINED FLOW, ABLATIVE FAST PYROLYSIS OF BIOMASS Quarterly Report, Apr. - Jun. 1981

J. P. DIEBOLD and J. SCAHILL Dec 1981 23 p refs
(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE82-005791, SERI/PR-622-1349) Avail. NTIS HC A02/MF A01

The shutdown, testing, preliminary operation, and minor modification of the 1-ton per day engineering demonstration reactor to fast pyrolyze biomass chips using an entrained flow ablative pyrolysis technique are reported for the period 1 April to 30 June 1981. DOE

N83-18880# Woods Hole Oceanographic Institution, Mass
PETROLEUM CONTAMINATION: QUANTIFICATION AND PASSIVE TAGGING IN ORGANISMS AND SEDIMENTS Final Report

J. W. FARRINGTON and B. W. TRIPP Mar 1982 171 p refs
(Contract EPA-R-802724)
(PB82-254087, EPA-600/3-82-012, ERLN-X36) Avail. NTIS HC A08/MF A01 CSCL 07D

Hydrocarbons in the marine environment are investigated with the goal of providing a background for evaluating methods for the measurement of petroleum pollution in marine organisms and sediments. Comparisons are made of extraction, isolation and measurement procedures applied to hard shell clams (*Mercenaria mercenaria*) and near shore and estuarine sediments. Gas chromatographic, gas chromatographic-mass spectrometric, and UV fluorescence techniques were used to analyze the hydrocarbons isolated by these procedures. GRA

N83-18883# Westinghouse Research and Development Center, Pittsburgh, Pa

TRACE AND MINOR ELEMENT REACTIONS IN FLUIDIZED-BED COMBUSTION PROCESSES Final Report, Aug. 1979 - Aug. 1981

M. A. ALVIN Jun. 1982 448 p refs
(Contract EPA-68-02-3110)
(PB82-240219; EPA-600/7-82-050) Avail. NTIS HC A19/MF A01 CSCL 07D

The results of thermodynamic equilibrium calculations for anticipated operating ranges for various fluidized-bed combustion (FBC) designs used to predict the potential volatility and interaction of 31 trace and minor elements contained in coal and sorbent feedstocks are given. The quantitative distribution of combustion products for trace and minor elements were predicted on the basis of assumptions concerning the multi-chemical reactions and interactions occurring throughout the FBC system. Predicted equilibrium concentrations for stack gas emissions and bottom ash material were correlated with in-field data for elemental partitioning. Potential pollutants of concern were identified based on discharge multimedia environmental goals (DMEGs). GRA

04 FUELS AND OTHER SOURCES OF ENERGY

N83-18924*# Colorado School of Mines, Golden. Dept. of Chemistry and Geochemistry
STUDIES OF THE MECHANISMS OF TURBINE FUEL INSTABILITY Final Report

S R DANIEL Jan. 1983 88 p refs

(Contract NSG-3122)

(NASA-CR-167963, NAS 1 26.167963) Avail NTIS HC A05/MF A01 CSCL 21D

The formation of insoluble deposits in a Jet A, a Diesel, and a model fuel (1/10 v/v tetralin/dodecane) was studied. Experiments were conducted using glass containers at 394 K with an air/fuel ratio of 14/1. The effects of addition of ppm levels of various compounds on deposit formation were evaluated. Nitrogen heterocycles were shown to produce a basicity dependent acceleration of deposition. Thiols and thiophene were shown to increase deposition while sulfides and disulfides act as inhibitors. Copper metal and its salts also promote deposition. Results of various instrumental analyses of deposits and development of a high performance liquid chromatographic method for monitoring deposit precursors are discussed. Author

N83-18944# SECO (Belgium)

GENERAL REVIEW OF WIND ENGINEERING PROBLEMS

R DHAVE *In* Von Karman Inst for Fluid Dyn Wind Effects on Buildings and Struct. 47 p 1982

Avail NTIS HC A16/MF A01

A new discipline called wind engineering has evolved during the last thirty years. Wind engineering is best described as the rational treatment of interactions between wind in the atmosphere boundary layer and human works on the surface of Earth. A rational treatment of wind effects is possible by a synthesis of knowledge from the fluid mechanics, meteorology, mechanics of structures and physiology. A historical view of wind engineering problems is presented. B W

N83-18964# National Academy of Sciences - National Research Council, Washington, D C. Marine Board.

TECHNOLOGIES FOR MEASUREMENT WHILE DRILLING

1982 191 p refs Proc of a Symp held in Washington, D C, 22-23 Oct 1981

(Contract NSF ODP-81-04383)

(PB82-243858) Avail NTIS HC A09/MF A01 CSCL 08I

Technology for measurement while drilling in the ocean margin drilling program is discussed. Mud pulse telemetry, hardware telemetry, detection needs for well control, pressure measurements downhole while drilling, and continuous wave mud telemetry are considered. Data utilization from measurement while drilling in seismic calibrations, drilling efficiency measurements, directional control with regard to telemetry, and measurement while coring are also reviewed. S L

N83-19078# Andros Analyzers, Inc., Berkeley, Calif.

DEVELOPMENT OF A CONTINUOUS METHANE MONITOR Open File Report, Jun. 1977 - Mar. 1980

I G BUROUGH Nov. 1981 46 p refs

(Contract DI-BM-H0-377072)

(PB82-244245, BM-OFR-93-82) Avail NTIS HC A03/MF A01 CSCL 14B

Two prototype continuous methane monitors capable of being mounted on a mining machine were designed and built for in mine safety use. The monitors incorporated a nondispersive infrared optical electronic analyzer design in which the response to the sample gas was achieved by synchronous detection and measurement of the amplitude oscillations of the transmitted energy from an infrared source caused by the pressure modulation of the sample gas within the optical cell. Zero and span stability were to be achieved by the amplitude modulating of the infrared source and using the detected signal to correct for optical electronic system variation. This design effort was to simplify and reduce the cost of the major components while eliminating the need for daily calibration. GRA

N83-19101# Alabama Univ., Huntsville. Environmental and Energy Center

DEMONSTRATION OF MODIFICATION OF A GASOLINE SPARK-IGNITED ENGINE TO PERMIT USING ETHANOL AS A FUEL

D. FREEMAN and J F PETERS Jan 1982 39 p refs

(Contract DE-FG07-81ID-12329)

(DE83-001384, DOE/ID-12329/T1) Avail NTIS HC A03/MF A01

A project to modify a 1980 Dodge Custom D-150 truck to run exclusively on hydrated ethyl alcohol is described. The modification was first accomplished using 200 proof (anhydrous) denatured ethanol. With the compression ratio increased to 12.1, the truck ran well on proofs as low as 160. A modification manual for conversion of gasoline engines to permit use of alcohol as a fuel is appended. DOE

N83-19155*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ERRSAC CONTRIBUTIONS TO THE SEARCH FOR APPALACHIAN HYDROCARBONS

H W BLODGET *In* its 2nd Eastern Reg Remote Sensing Appl Conf. p 125-128 1981 refs ERTS

Avail: NTIS HC A17/MF A01 CSCL 08G

The utility of lineaments identified on LANDSAT imagery as an exploration tool in the search for hydrocarbons within three Appalachian test sites were assessed. The optimum LANDSAT imagery enhancement technique for displaying lineaments was identified. The LANDSAT lineament data were analyzed and results were correlated with oil and gas field information for each of three test sites. Good correlations were found for several states. Successful techniques can be incorporated into a broader exploration model. A R H.

N83-19183*# Jet Propulsion Lab., California Inst of Tech., Pasadena

AUTOMATION OF THE LONGWALL MINING SYSTEM

W. ZIMMERMAN, R. ASTER, J. HARRIS, and J. HIGH 1 Nov 1982 116 p refs Prepared for DOE, Washington, D C

(Contract NAS7-918, DE-AI01-76ET-12548)

(NASA-CR-169933, JPL-PUB-82-99, DOE/JPL-12548/16; NAS 1.26 169933) Avail NTIS HC A06/MF A01 CSCL 08I

Cost effective, safe, and technologically sound applications of automation technology to underground coal mining were identified. The longwall analysis commenced with a general search for government and industry experience of mining automation technology. A brief industry survey was conducted to identify longwall operational, safety, and design problems. The prime automation candidates resulting from the industry experience and survey were (1) the shearer operation, (2) shield and conveyor pan line advance, (3) a management information system to allow improved mine logistics support, and (4) component fault isolation and diagnostics to reduce untimely maintenance delays. A system network analysis indicated that a 40% improvement in productivity was feasible if system delays associated with all of the above four areas were removed. A technology assessment and conceptual system design of each of the four automation candidate areas showed that state of the art digital computer, servomechanism, and actuator technologies could be applied to automate the longwall system. S L.

04 FUELS AND OTHER SOURCES OF ENERGY

N83-19196# Bendix Field Engineering Corp., Grand Junction, Colo

URANIUM HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE OF THE BARTER ISLAND NTMS QUADRANGLE, ALASKA

S L LANGFELDT, L G HARDY, R F DANDREA, JR., R J ZINKL, D L SHETTEL, JR, M M MINOR, C MCINTEER, J N HANSEL, and D R BROXTON Jan 1982 14 p refs Prepared in cooperation with Los Alamos Scientific Lab (Contract DE-AC13-76GJ-01664)

(DE82-009666, GJBX-6-82) Avail NTIS HC A02/MF A01

Results of a hydrogeochemical and stream sediment reconnaissance (HSSR) of the Barter Island NTMS quadrangle, Alaska are reported. The sample media and summary of the analytical results for each medium are described. The data are subdivided into groups of stream sediment and lake sediment samples. DOE

N83-19197# Bendix Field Engineering Corp., Grand Junction, Colo

URANIUM HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE OF THE TANACROSS NTMS QUADRANGLE, ALASKA

S L LANGFELDT, L C HARDY, R F DANDREA, JR, R. J. ZINKL, D L SHETTEL, JR, S. R GARCIA, D. HANKS, W. E. GEORGE, and S L BOLIVAR Jan. 1982 140 p refs Prepared in cooperation with Los Alamos Scientific Lab. (Contract DE-AC13-76GJ-01664)

(DE82-009664, GJBX-4-82) Avail NTIS HC A07/MF A01

A hydrogeochemical and stream sediment reconnaissance (HSSR) of the Tanacross NTMS quadrangle Alaska is reported. Location data, field analyses, and laboratory analyses of several different sample media are presented. The sample media and the analytical results for each medium are summarized. The data are subdivided into groups of stream sediment and lake sediment samples. Each group with a sufficient number of observations, statistical tables, tables of raw data and 1:1,000,000 scale maps of pertinent elements and maps showing results of multivariate statistical analyses are included. DOE

N83-19198# Intercomp Resources Development and Engineering Corp., Denver, Colo

TYPE-CURVE ANALYSIS OF PRESSURE BUILDUP FROM VERTICALLY FRACTURED WELLS IN LOW PERMEABILITY RESERVOIRS

Mar 1982 40 p refs

(Contract DE-AC19-79BC-10106)

(DE82-010513, DOE/BC-10106/28) Avail NTIS HC A03/MF A01

A set of type curves for use in analyzing pressure buildup data from vertically fractured wells was developed. The curves account for the length of time the well was on production before it was shut-in for the buildup test. Estimates of permeability, fracture half length, and fracture conductivity are given from pressure buildup analysis using the curves. The results from Horner analysis of pressure buildup data show vertically fractured wells are affected by the length of time a well was on production prior to starting the buildup test. Long dimensionless flow times are needed for the Horner straight line to develop. This means that extremely long flow times are needed for Horner analysis to be used on pressure buildup data from massive hydraulic fractured wells in low permeability reservoirs. Several examples are given of analyzing pressure buildup data using the type curves. DOE

N83-19216*# Institute of Gas Technology, Chicago, Ill.

VEHICLE CONVERSION TO HYBRID GASOLINE/ALTERNATIVE FUEL OPERATION Final Report, Apr. - Sep. 1982

T D DONAKOWSKI Nov. 1982 45 p refs Prepared for JPL 2 Vol

(Contract NAS7-100, JPL-956210, JPL PROJ 65906)

(NASA-CR-169911, NAS 1.26:169911) Avail: NTIS HC A03/MF A01 CSCL 10A

The alternative fuels considered are compressed natural gas (CNG), liquefied natural gas (LNG), liquid petroleum gas (LPG), and methanol, vehicles were required to operate in a hybrid or dual-fuel gasoline/alternative fuel mode. Economic feasibility was determined by comparing the costs of continued use of gasoline fuel with the use of alternative fuel and retrofitted equipment. Differences in the amounts of future expenditures are adjusted by means of a total life-cycle costing. All fuels studied are technically feasible to allow a retrofit conversion to hybrid gasoline/alternative fuel operation except for methanol. Conversion to LPG is not recommended for vehicles with more than 100,000 km (60,000 miles) of prior use. Methanol conversion is not recommended for vehicles with more than 50,00 km (30,000 miles). Author

N83-19217*# Institute of Gas Technology, Chicago, Ill

HYBRID FUEL CELL/DIESEL GENERATION TOTAL ENERGY SYSTEM, PART 2 Final Report, Apr. - Sep. 1982

C F BLAZEK Nov. 1982 88 p refs Prepared for JPL 2 Vol

(Contract NAS7-100, JPL-956210, JPL PROJ 65906)

(NASA-CR-169912; NAS 1.26:169912) Avail: NTIS HC A05/MF A01 CSCL 10A

Meeting the Goldstone Deep Space Communications Complex (DGSCC) electrical and thermal requirements with the existing system was compared with using fuel cells. Fuel cell technology selection was based on a 1985 time frame for installation. The most cost-effective fuel feedstock for fuel cell application was identified. Fuels considered included diesel oil, natural gas, methanol and coal. These fuel feedstocks were considered not only on the cost and efficiency of the fuel conversion process, but also on complexity and integration of the fuel processor on system operation and thermal energy availability. After a review of fuel processor technology, catalytic steam reformer technology was selected based on the ease of integration and the economics of hydrogen production. The phosphoric acid fuel cell was selected for application at the DGSCC due to its commercial readiness for near term application. Fuel cell systems were analyzed for both natural gas and methanol feedstock. The subsequent economic analysis indicated that a natural gas fueled system was the most cost effective of the cases analyzed. Author

N83-19230# Comptroller General of the United States, Washington, D C

STATUS OF THE GREAT PLAINS COAL GASIFICATION PROJECT, AUGUST 1982 Report to the Congress

14 Sep. 1982 37 p refs

(GAO/EMD-82-117) Avail NTIS HC A03/MF A01

Construction of the Great Plains coal gasification plant is reported. Project costs, the management system and the computerized information system are covered. Federal auditing is discussed. Author

N83-19237*# Pacific Northwest Lab., Richland, Wash.

PUTTING WIND RESOURCE ATLASES TO USE

D L ELLIOTT In NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 141-156 1982 refs (Contract DE-AC06-76RL-01830)

Avail NTIS HC A99/MF A01 CSCL 10A

An assessment of an area's wind resource and proper site selection are critical to the successful utilization of wind energy. How the twelve recently published wind energy resource atlases for the United States and its territories can be used to evaluate in the atlas on various geographic scales (regional, state and station) and time scales (annual, seasonal and diurnal) is discussed. In addition to techniques for extracting the magnitude of the wind

04 FUELS AND OTHER SOURCES OF ENERGY

resource, methods are presented for estimating the seasonal and diurnal variations of the wind resource for an area, the certainty with which the resource has been estimated and the fraction of land area with a given wind resource
Author

N83-19238*# Pacific Northwest Lab., Richland, Wash
APPROACHES TO WIND RESOURCE VERIFICATION
W R BARCHET /in NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 159-170 1982 refs
(Contract DE-AC06-76RL-01830)
Avail: NTIS HC A99/MF A01 CSCL 04B

Verification of the regional wind energy resource assessments produced by the Pacific Northwest Laboratory addresses the question: Is the magnitude of the resource given in the assessments truly representative of the area of interest? Approaches using qualitative indicators of wind speed (tree deformation, eolian features), old and new data of opportunity not at sites specifically chosen for their exposure to the wind, and data by design from locations specifically selected to be good wind sites are described. Data requirements and evaluation procedures for verifying the resource are discussed.
Author

N83-19239*# Pacific Northwest Lab., Richland, Wash
ASSESSING THE REPRESENTATIVENESS OF WIND DATA FOR WIND TURBINE SITE EVALUATION
D. S. RENNE and R B COROTIS (Northwestern Univ) /in NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 173-190 1982 refs
(Contract DE-AC06-76RL-01830)
Avail: NTIS HC A99/MF A01 CSCL 04B

Once potential wind turbine sites (either for single installations or clusters) are identified through siting procedures, actual evaluation of the sites must commence. This evaluation is needed to obtain estimates of wind turbine performance and to identify hazards to the machine from the turbulence component of the atmosphere. These estimates allow for more detailed project planning and for preliminary financing arrangements to be secured. The site evaluation process can occur in two stages. (1) utilizing existing nearby data, and (2) establishing and monitoring an onsite measurement program. Since step (2) requires a period of at least 1 yr or more from the time a potential site has been identified, step (1) is often an essential stage in the preliminary evaluation process. Both the methods that have been developed and the unknowns that still exist in assessing the representativeness of available data to a nearby wind turbine site are discussed. How the assessment of the representativeness of available data can be used to develop a more effective onsite meteorological measurement program is also discussed.
Author

N83-19240*# Pacific Northwest Lab., Richland, Wash.
WIND TURBINE SITING: A SUMMARY OF THE STATE OF THE ART
T. R. HIESTER /in NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 195-212 1982 refs
(Contract DE-AC06-76RL-01830; EPRI PROJ. RP-1520-1)
Avail: NTIS HC A99/MF A01 CSCL 10A

The process of siting large wind turbines may be divided into two broad steps: site selection, and site evaluation. Site selection is the process of locating windy sites where wind energy development shows promise of economic viability. Site evaluation is the process of determining in detail for a given site the economic potential of the site. The state of the art in the first aspect of siting, site selection is emphasized. Several techniques for assessing the wind resource were explored or developed in the Federal Wind Energy Program. Local topography and meteorology will determine which of the techniques should be used in locating potential sites. None of the techniques can do the job alone, none are foolproof, and all require considerable knowledge and experience to apply correctly. Therefore, efficient siting requires a strategy which is founded on broad based application of several techniques without relying solely on one narrow field of expertise.
Author

N83-19250*# Murray and Trettel, Inc., Northfield, Ill
THE USEFUL POTENTIAL OF USING EXISTING DATA TO UNIQUELY IDENTIFY PREDICTABLE WIND EVENTS AND REGIMES, PART 1

D. W. TRETTEL, J. T. AQUINO, T. R. PIAZZA, L. E. TAYLOR, and D. C. TRASK /in NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 357-374 1982 refs
(Contract PNL-B-6618-AN)

Avail: NTIS HC A99/MF A01 CSCL 04B

Correlations between standard meteorological data and wind power generation potential were developed. Combined with appropriate wind forecasts, these correlations can be useful to load dispatchers to supplement conventional energy sources. Hourly wind data were analyzed for four sites, each exhibiting a unique physiography. These sites are Amarillo, Texas, Ludington, Michigan; Montauk Point, New York; and San Geronio, California. Synoptic weather maps and tables are presented to illustrate various wind 'regimes' at these sites.
M G

N83-19251*# Freese-Notis Weather, Inc., Des Moines, Iowa.
THE USEFUL POTENTIAL OF USING EXISTING DATA TO UNIQUELY IDENTIFY PREDICTABLE WIND EVENTS AND REGIMES, PART 2

C. NOTIS /in NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 375-390 1982 refs

Avail: NTIS HC A99/MF A01 CSCL 04B

Wind data from four sites were stratified and found to naturally fit into a few unique groups. These were compared with synoptic weather patterns using the Booz-Allen classification system. Strong relationships became evident between a particular synoptic type and wind events for each site. Statistics indicate certain patterns which result in strong winds and some that result in weak winds. For each site there is a preferred wind direction associated with the strongest speed. Important relationships were also found comparing 850-mb and surface wind. Additionally, comparisons between pressure gradient and wind speed for a given gradient direction show some significant relationships. It can be stated that the overall results show what by using existing data for any site, the winds can be characterized and correlated with synoptic weather patterns. As a result, reliable wind forecasts can be made for utility companies for the purpose of power generation.
M G

N83-19270*# JBF Scientific Corp., Wilmington, Mass
ECONOMICS OF WIND ENERGY FOR UTILITIES

T. F. MCCABE and M. GOLDENBLATT /in NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 783-798 1982
Avail: NTIS HC A99/MF A01 CSCL 10A

Utility acceptance of this technology will be contingent upon the establishment of both its technical and economic feasibility. This paper presents preliminary results from a study currently underway to establish the economic value of central station wind energy to certain utility systems. The results for the various utilities are compared specifically in terms of three parameters which have a major influence on the economic value: (1) wind resource, (2) mix of conventional generation sources, and (3) specific utility financial parameters including projected fuel costs. The wind energy is derived from modeling either MOD-2 or MOD-0A wind turbines in wind resources determined by a year of data obtained from the DOE supported meteorological towers with a two-minute sampling frequency. In this paper, preliminary results for six of the utilities studied are presented and compared.
B.W

N83-19299# Alaska Univ., Fairbanks Geophysical Inst.
GEOTHERMAL ENERGY RESOURCE ASSESSMENT OF PARTS OF ALASKA Final Report

E. M. WESCOTT, D. L. TURNER, and J. KIENLE Aug 1982
73 p refs

(Contract DE-FC07-79ET-27034)

(DE83-000140, DOE/ET-27034/T2) Avail: NTIS HC A04/MF A01

The central Seward Peninsula was surveyed for geological, geophysical and geochemical reconnaissance during a 30 day period in the summer of 1980. The survey investigated the

geothermal energy resource potential of this region of Alaska. A continental rift system model explains many of the Late Tertiary to Quaternary topographic, structural, volcanic and geothermal features of the region. Geologic evidence for the model includes normal faults, extensive fields of young alkalic basalts, alignment of volcanic vents, graben valleys and other features consistent with a rift system active from late Miocene time to the present. Gravity, helium and mercury soil concentrations were measured along the traverses. Seismic, resistivity, and VLF studies are presented. DOE

N83-19302# Sandia Labs, Albuquerque, N. Mex
HIGH-TEMPERATURE GEOTHERMAL CABLEHEADS

J. A. COQUAT and R. W. EIFERT. Nov 1981. 27 p.
 (Contract DE-AC04-76DP-00789)
 (DE82-005864; SAND-81-2542) Avail. NTIS HC A03/MF A01

Two high temperature, corrosion resistant logging cable heads which use metal seals and a stable fluid to achieve proper electrical terminations and cable sonde interfacing are described. A tensile bar provides a calibrated yield point, and a cone assembly anchors the cable armor to the head. Electrical problems of the sort generally ascribable to the cable sonde interface were absent during demonstration hostile environment loggings in which these cable heads were used. DOE

N83-19310# National Bureau of Standards, Washington, D. C.
National Engineering Lab

OIL AND GAS SUPPLY MODELING Final Report

S. I. GASS. May 1982. 781 p. refs. Proc. of a Symp. held at Washington, D. C., 18-20 Jun 1980. Sponsored in part by DOE (PB82-234139, NBS-SP-631, LC-82-600508) Avail. NTIS HC A99/MF A01 CSCL 10A

The theoretical and applied state of the art of oil and gas supply models was discussed. The following areas were addressed: the realities of oil and gas supply, prediction of oil and gas production, problems in oil and gas modeling, resource appraisal procedures, forecasting field size and production, investment and production strategies, estimating cost and production schedules for undiscovered fields, production regulations, resource data, sensitivity analysis of forecasts, econometric analysis of resource depletion, oil and gas finding rates, and various models of oil and gas supply. GRA

N83-19378# Hawaii Inst. of Geophysics, Honolulu
PRELIMINARY GEOTHERMAL EVALUATION OF THE MOKAPU PENINSULA ON THE ISLAND OF OAHU, HAWAII

Jun. 1982. 43 p. refs. Sponsored by the Naval Weapons Center (AD-A119158, NWC-TP-6358) Avail. NTIS HC A03/MF A01 CSCL 08G

Preliminary geological, geochemical, and geophysical field surveys were conducted on Mokapu Peninsula on the island of Oahu in an effort to determine whether sufficient indications of geothermal potential exist within or adjacent to the peninsula to justify further, more detailed, exploratory efforts. Results of the investigation indicate a very low probability of a geothermal resource beneath the peninsula. Author (GRA)

N83-19812*# Arkansas State Univ., State University
VAPORIZATION THERMODYNAMICS OF K₂S AND K₂SO₃ Final Report

J. E. BENNET. Jun. 1982. 65 p. refs.
 (Contract NSG-3249; DE-AI01-77ET-10769)
 (NASA-CR-168080, DOE/NASA/3249-1, NAS 1 26-168080)
 Avail. NTIS HC A04/MF A01 CSCL 20M

The vaporization reactions, vapor pressures, and thermodynamics of potassium sulfide and potassium sulfate were studied for purposes of providing fundamental data for the seed cycle in magnetohydrodynamic electric power generation. Rate of effusion studies, supported by tube furnace experiments, X-ray powder diffraction, mass spectrometry and appropriate chemical analyses and tests, revealed that potassium sulfite disproportionates at high temperatures to form potassium sulfide

and potassium sulfate. Potassium sulfide was observed to vaporize incongruently, the initial vapors being predominantly potassium atoms, with minor species being S₂ and various K-S molecules. The ratio of K/S₂ in the vapor is very large initially and decreases steadily with prolonged heating. Several materials were evaluated for purposes of containing K₂S/K₂SO₃ at temperatures or = 800 C. Pt, Mo, W, quartz, machinable glass, BN, high density graphite, pyrolytic coated graphite, and alumina. Of these, only alumina was observed to be chemically inert to both K₂S but reacted with K₂SO₃. The other materials were not suitable for either substance. Thermodynamic calculations based on measured vapor pressures and approximate free energy functions are described. Results from isothermal total mass loss experiments and from thermogravimetric experiments are also included. S.L.

N83-19827# Exxon Research and Engineering Co., Florham Park, N.J.

EDS COAL-LIQUEFACTION PROCESS DEVELOPMENT. PHASE 5: EDS PRODUCT QUALITY Final Report

W. R. EPPERLY. Sep. 1982. 266 p. Sponsored in part by Exxon Co., Inc., Electric Power Research Inst., Japan Coal Liquefaction Development Co., Phillips Coal Co., Anaconda Minerals Co., Ruhrkohle, AG, and ENI (Contract DE-FC05-77ET-10069)

(DE83-002226, DOE/ET-10069/T22; FE-2893-97) Avail. NTIS (US Sales Only) HC A12/MF A01, DOE Depository Libraries

Research efforts directed at end use applications of raw and upgraded EDS products are summarized. The end use applications, including any upgrading by hydrotreatment required to ensure adequate performance, are identified for products derived from Illinois (Monterey mine) and Wyoming (Wyodak mine) coals. The EDS product quality studies identified potential end uses for coal derived liquids and evaluated properties of these liquids relative to requirements of these potential applications. Areas pertaining to product quality requiring further development are highlighted. Consideration of market needs combined with generic properties of EDS-derived products may suggest a clean product slate (naphtha/distillate) as the most desirable, long range EDS product objective. Properties of lighter EDS product streams (naphtha, distillates) are essentially independent of liquefaction operating conditions for a given coal. This applies to both coal only and bottoms recycle operations. With the exception of heterocyclic content, primarily sulfur, properties of lighter EDS product streams (naphtha, distillates) are very nearly coal independent. DOE

N83-19829# Massachusetts Inst. of Tech., Cambridge. Energy Lab

COAL PYROLYSIS BY HOT SOLIDS FROM A FLUIDIZED-BED COMBUSTOR Final Technical Report, Jun. 1977 - Jun. 1982

J. P. LONGWELL, L. B. EVANS, J. B. HOWARD, W. A. PETERS, J. K. FLOESS, L. FONG, C. CHEN, and J. YEBOAH. Jun. 1982. 68 p. refs.

(Contract DE-AT01-76ET-10703; EX-76-A-01-2295)
 (DE83-003344, DOE/ET-10703/1301) Avail. NTIS HC A04/MF A01

The effect of adding calcined dolomite stone to the fluidized-bed pyrolysis of coal and oil shale on product quality and product distribution has been studied. This work has provided information relevant to systems where heat is generated by fluidized-bed combustion in the presence of a sulfur acceptor (dolomite) and where the hot stone from the combustor is used in a second reactor to provide heat for pyrolysis. A scoping economic analysis indicated that, for coal, the pyrolysis gas and liquids produced are lower cost than gas and liquids produced by single-product gasification and liquefaction processes. The presence of calcium oxide during pyrolysis was found to improve gas heating value by CO₂ removal and to essentially eliminate H₂S. Gas yield was increased at the expense of liquid yield (20 to 30% reduction). Tar properties were improved by reduction of oxygen content, however, little sulfur or nitrogen removal was observed. Used stone from a fluidized-bed combustor gave results comparable to fresh stone with little reduction of the calcium sulfate present in the used stone. Since Colorado oil shale contains dolomite and calcite,

04 FUELS AND OTHER SOURCES OF ENERGY

stones from spent-shale combustion might be expected to have similar effects on product yields CO₂ and H₂S removal from the gas were observed DOE

N83-19853# New York State Univ., Binghamton Dept of Chemistry
DESULFURIZATION WITH TRANSITION-METAL CATALYSIS
Quarterly Technical Progress Report, 27 Dec. 1981 - 27 Mar. 1982

J J EISCH 28 Apr. 1982 5 p
(Contract DE-FG22-81PC-40782)
(DE82-013964, DOE/PC-40782/T1) Avail NTIS HC A02/MF A01

The following studies were initiated or continued (1) study of the desulfurizing action of nickel salts or organonickel complexes, combined with metal hydrides, or SRC plant liquids, (2) continuing survey of other model organosulfur compounds that might undergo desulfurization with such nickel reagents, either performed or prepared in situ, (3) evaluation of molybdenum complexes as desulfurizing agents, (4) formation of nickel hydrides by oxidative additions and their behavior as desulfurizing agents, and (5) exploration of the denitrogenation of quinolines by reductive hydrolysis. The following observations have been made (1) SRC liquids (code No M-51) containing 0.5% of sulfur underwent loss of 80% of their sulfur when treated with nickel salts, pyridine and a metal hydride, (2) sulfones can be reduced to hydrocarbons by the joint action of nickel salts and metal hydrides, (3) under conditions thus far tried, molybdenum salts and metal hydrides appear to be desulfurizing agents that are inferior to those of nickel or cobalt, (4) nickel(0) complexes interact with aluminum hydrides to evolve hydrogen, and (5) some model 1,2-dihydroquinolines are being synthesized to test the feasibility of reductive denitrogenation DOE

N83-19854# General Electric Co., Philadelphia, Pa. Research and Engineering Dept

COAL DESULFURIZATION BY A MICROWAVE PROCESS
Progress Report

P D ZAVITSANOS, J. A. GOLDEN, and K. W. BLEILER Jan 1982 25 p refs
(Contract DE-AC22-80PC-30142)
(DE82-007514; DOE/PC-30142/T3) Avail: NTIS HC A02/MF A01

Desulfurization experiments have been carried out using the moving bed flow reactor to examine the following. (1) hardgrove grindability index of microwave treated coal compared with raw coal, (2) washability of microwave treated coal compared with raw coal, (3) the extent of sulfur and ash removal from alkali/coal treated samples. In the washability experiments, the following treatment sequence was carried out: expose raw coal (1-2 in size) to microwaves (2 kW power level, 120 to 240 sec exposure), crush (30 to 200 mesh), float/sink (1.6 SG). Sulfur, ash and CV measurements were made on the float fractions for comparison with similar measurements on raw coal samples prepared in the same way as microwave treated samples. Table 2 is a summary of the sulfur, ash and calorific value analyses comparing washed with raw coal samples. These data were used to calculate percent energy recovery as shown in the table. It is not possible to conclude from the data taken to date whether there is beneficiation from microwave treated-washed coal since two coals showed increased energy recovery and two did not. Additional washability data will be taken to pursue this question DOE

N83-19858# Battelle Columbus Labs., Ohio
SYNTHETIC-FUEL AROMATICITY AND STAGED COMBUSTION
Quarterly Progress Report, 1 Oct. - 31 Dec. 1981

A. LEVY, J. R. LONGANBACH, and L. K. CHAN 31 Jan. 1982 20 p refs
(Contract DE-AC22-80PC-30302)
(DE82-010302, DOE/PC-30302/5; QPR-5) Avail NTIS HC A02/MF A01

The objectives of the five tasks are as follows (1) determine the volatility and to characterize the aromatic and fuel-N compounds

present in a typical synfuel; (2) determine the aromatic and fuel-N characteristics of narrow (50 C) distillation cuts of synfuel as a function of time, temperature and oxygen level, (3) determine the ease of oxidation of the pyrolysis products, (4) define the burning characteristics of synfuel as a function of equivalence ratio, temperature and residence time in two-stage combustion, (5) apply the results from Task 2, 3 and 4 into existing models for soot and NO/sub x/ formation in flames. Results obtained on total nitrogen analyses of the fuels and condensable products have been found to lack needed precision and accuracy. Test samples are currently being analyzed by a third laboratory. A similar series of test done to evaluate the titration method for the determination of basic nitrogen has shown excellent precision and accuracy. Pyrolysis and oxidative experiments have been extended to 1100 C at the percent of stoichiometric oxygen to 70% of the oxygen required for complete combustion DOE

N83-19860# Pennsylvania State Univ., University Park. Coal Research Section

RELATIONSHIPS BETWEEN COAL CONSTITUTION, THERMOPLASTIC PROPERTIES AND LIQUEFACTION BEHAVIOR OF COALS AND VITRINITE CONCENTRATES FROM THE LOWER KITTANNING SEAM, PART 1 Final Report

J. T. SENFTLE and A. DAVIS Jan 1982 240 p refs
(Contract DE-AC22-80PC-30013)
(DE82-012848; DOE/PC-30013/T2-PT-1) Avail: NTIS HC A11/MF A01

The major objective of this study was to assemble a base of coal data in order to reveal systematic interrelationships among the chemical and petrographic compositions and the liquefaction behavior and thermoplastic properties of coal from a single coal seam. Trends in the lateral variability of carbon, hydrogen, nitrogen, oxygen, sulfur contents, volatile matter, ash yields, petrographic composition, and reflectance are presented. These trends in the composition and properties within a single coal seam enabled the areal changes in depositional environment and post-depositional metamorphic changes to be evaluated. The liquefaction behavior and thermoplastic properties of any coal would seem to be dependent upon the constitution of the parent coal, however, the petrographic, physical and chemical heterogeneity of coal and complexity of the liquefaction and thermoplasticity processes make a study of the interrelationships extremely difficult. Consequently, a complex statistical analysis of these variables has been used DOE

N83-19862# Exxon Research and Engineering Co., Florham Park, N.J.

EDS COAL-LIQUEFACTION PROCESS DEVELOPMENT, PHASE 5 Quarterly Progress Report, 1 Oct. - 31 Dec. 1981

Mar 1982 312 p refs
(Contract DE-FC01-77ET-10069)
(DE82-012444; DOE/ET-10069/T17; FE-2893-83) Avail: NTIS (US Sales Only) HC A14/MF A01; DOE Depository Libraries

Operation of the recycle liquefaction units and the coal liquefaction pilot plant with various coals is reported giving yields and product data. Solvent hydrogenation studies at low process pressure (900 psig) showed that the severity of hydrogenation at these conditions decreased in agreement with the model of hydrogenation. Combustion tests of coal-derived fuels were performed in a 1450 hp boiler. Fractionation and hydrogenation of coal liquids was carried out to prepare experimental gasoline blending stock and diesel fuels (with cetane improvers). Experiments involving radioactive tracers were carried out to get data on holdups, residence time and the degree of backmixing needed for plant engineering and design. Other operations are discussed briefly (LTN) DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-19865# Systems Science and Software, San Diego, Calif. **DYNAMIC SIMULATION OF SULFUR-REMOVAL SYSTEMS Final Report**

J H ALEXANDER, T R BLAKE, D. H. BROWNELL, JR., W D. HENLINE, and D E. WILKINS Jan 1982 104 p refs Sponsored by DOE

(DE82-902074; EPRI-AP-2187) Avail. NTIS HC A06/MF A01

A generalized computer simulation was developed to predict the dynamic response of alternate gas absorption systems for selective removal of sulfur compounds or ammonia from fuel gas or synthesis gas produced from coal or other fossil fuels. The models use numerical methods based upon finite difference techniques to determine the spatial distribution of process variables within both the absorption and regeneration columns of such gas cleanup processes. The simulator may be applied to systems for selective gas absorption based on either chemical or physical principles. Examples of such systems include the Benfield process based on absorption by chemical reaction with an activated alkali carbonate solvent, and the allied SELEXOL solvent process based on physical absorption as a result of partial pressure differences of the gas components above an organic solvent system. Simulations of either individual process units or an entire integrated plant can be performed DOE

N83-19866# Department of Energy, Pittsburgh, Pa Energy Technology Center

FORMATION/DECOMPOSITION OF CONDENSIBLE HYDROCARBONS DURING THE GASIFICATION OF COAL

D V NAKLES, J P FILLO, M. J MASSEY, and J P STRAKEY Apr 1982 65 p refs

(DE82-014493; DOE/PETC/TR-82/11) Avail NTIS HC A04/MF A01

Production and composition of condensible hydrocarbons, commonly referred to as tars and oils, from the gasification of coal vary significantly with gasifier design and operation. Major process parameter such as gas-solid contacting, coal heating rates, reaction temperature, and product gas residence time influence both the initial formation and subsequent decomposition/reaction of hydrocarbons in the gasifier. The 4 inch diameter fluidized bed gasifier was used to segregate, quantitatively, the roles of formation/decomposition phenomena on the quantity and character of hydrocarbons produced during coal gasification. Specifically, production characteristics of both hydrocarbon condensates (i.e., tars and oils) and dissolved organics (mainly phenol) in the aqueous condensates were monitored while systematically varying process operating conditions. DOE

N83-19868# Brigham Young Univ, Provo, Utah Combustion Lab

PREDICTION AND MEASUREMENT OF OPTIMUM OPERATING CONDITIONS FOR ENTRAINED COAL-GASIFICATION PROCESSES. VOLUME 2: USER'S MANUAL FOR A COMPUTER PROGRAM FOR 1-DIMENSIONAL COAL COMBUSTION OR GASIFICATION (1-DICOG) Final Report, 1 Nov. 1979 - 31 Dec. 1981

P J SMITH and J. D SMOOT Dec 1981 328 p refs Sponsored in part by Electric Power Research Inst. 3 Vol (Contract DE-AC21-80MC-14380)

(DE82-015610; DOE/MC-14380/1210-VOL-2) Avail: NTIS HC A15/MF A01

A one dimensional, steady-state model describing pulverized coal combustion and gasification is presented. Emphasis was placed on the description of the coal reaction processes and gas-particle interactions, one dimensional fluid mechanics and particle-particle, particle-wall radiation were included as well. Moisture vaporization from the coal particles, multi-step coal pyrolysis, and heterogeneous char oxidation by multiple oxidizers are modeled for polydispersed coal particle sizes or types. Although the formulation is one dimensional, mixing rates of primary and secondary streams and recirculation within the reactor were accounted for as specified input. The resulting model predicts thermal, chemical, and physical histories for both the gaseous and particle phases. Gas-particle interactions account for

appropriate diffusion and kinetic rates. Gas phase reactions are assumed to be in local chemical equilibrium DOE

N83-19869# Brigham Young Univ, Provo, Utah Combustion Lab

PREDICTION AND MEASUREMENT OF OPTIMUM OPERATING CONDITIONS FOR ENTRAINED COAL-GASIFICATION PROCESSES. VOLUME 3: USER'S MANUAL FOR A COMPUTER PROGRAM FOR 2-DIMENSIONAL COAL GASIFICATION OR COMBUSTION (PCGC-2) Final Report, 1 Nov. 1979 - 31 Dec. 1981

P J SMITH and L D SMOOT Dec 1981 166 p refs Sponsored in part by Electric Power Research Inst. 3 Vol. (Contract DE-AC21-80MC-14380)

(DE82-015611; DOE/MC-14380/1210-VOL-3) Avail: NTIS HC A08/MF A01

A two dimensional, steady-state model for describing pulverized coal combustion and gasification is presented. The model is applicable to cylindrical axis-symmetric systems. Turbulence is accounted for in both the fluid mechanics equations and the combustion scheme. Radiation from gases, wall, and particles is taken into account using a flux method. The particle phase is modeled in a Lagrangian framework so that individual paths of particles are followed. A two-step coal devolatilization scheme is used along with a heterogeneous reaction scheme that allows for both diffusion and chemical reaction. Gas-phase reactions are modeled assuming infinite rate kinetics, meaning that the reaction rates are limited by the turbulent rate of mixing. The gas phase is described by elliptic partial differential equations that are solved by an iterative line-by-line technique. Under-relaxation is used to achieve numerical stability DOE

N83-19870# Utah Univ, Salt Lake City Dept of Mining and Fuels Engineering.

CHEMISTRY AND CATALYSIS OF COAL LIQUEFACTION: CATALYTIC AND THERMAL UPGRADING OF COAL LIQUID AND HYDROGENATION OF CO TO PRODUCE FUELS Quarterly Progress Report, Oct. - Dec. 1981

W H WISER Mar 1982 81 p refs

(Contract DE-AC22-79ET-14700)

(DE82-012474; DOE/ET-14700/9) Avail NTIS HC A05/MF A01

Experiments on the upgrading of coal liquids by catalytic hydrogenation are reported. Catalysts, nuclear magnetic resonance and other related basic research are discussed DOE

N83-19872# Transco Energy Co, Houston, Tex **TRANSCO MEDIUM-BTU COAL GASIFICATION PROJECT: FEASIBILITY STUDY, VOLUME 1 Final Report**

Mar. 1982 465 p 3 Vol

(Contract DE-FG01-81RA-50381)

(DE82-009597; DOE/RA-50381/1156-VOL-1) Avail: NTIS HC A21/MF A01

The results of the preliminary facility design portion of Transco's overall feasibility study are given. The objective is to develop the conceptual design and cost estimate for a coal gasification plant producing medium-Btu fuel gas from Texas lignite. The preliminary plant design presented in utilizes commercially proven technology. Capital investment and operating costs were developed based on fourth quarter-1981 costs. No projection is included for escalation. The cost estimates for the selected process configuration are included. Also process alternative studies are summarized. DOE

N83-19873# Transco Energy Co, Houston, Tex **TRANSCO MEDIUM-BTU COAL GASIFICATION PROJECT: FEASIBILITY STUDY, VOLUME 2 Final Report**

Mar 1982 573 p 3 Vol

(Contract DE-FG01-81RA-50381)

(DE82-009596; DOE/RA-50381/1156-VOL-2) Avail: NTIS HC A24/MF A01

The economic analysis of a coal gasification production facility estimated a minimum constant real cost of medium Btu of \$6.30/MMBtu. The most likely competitive fuels for the MBG are natural gas and low sulfur No. 6 fuel oil. Most forecasters now

04 FUELS AND OTHER SOURCES OF ENERGY

expect that deregulated gas prices existing by the time this plant could be producing MBG, 1989, will be priced competitively with low sulfur No 6 fuel oil on a heating value basis at the burner tip. For this reason, the comparison presented is based on 1981 prices paid for low sulfur (0.7%) No 6 fuel oil on the Gulf Coast. Average spot prices are used to remove distortions from old contracts. The average of the 1981 spot prices published in Platt's Oilgram for 0.7% sulfur No 6 fuel oil in the Gulf Coast market was \$5.13/MMBtu. Ignoring both the small unit costs for fuel oil transportation and the burner modifications required to use MBG, the MBG cost is 23% above the fuel oil average in 1981. DOE

N83-19874# Transco Energy Co., Houston, Tex
TRANSCO MEDIUM-BTU COAL GASIFICATION PROJECT: FEASIBILITY STUDY, VOLUME 3 Final Report
Mar. 1982 537 p refs 3 Vol.
(Contract DE-FG01-81RA-50381)
(DE82-009595, DOE/RA-50381/1156-VOL-3) Avail: NTIS HC A23/MF A01

Environmental, health, safety and socio-economic assessments; a management plan, regulations in Texas for such plants; environmental effects of the associated gas pipeline, general equipment specifications, Lurgi process drawings; and permit application forms to be completed for a coal gasification plant are discussed. Burner modifications to go to intermediate Btu gas from natural gas and a list of plant species in the pipeline path are given. DOE

N83-19876# Sandia Labs., Albuquerque, N. Mex
MULTIPLE-TRACER GAS ANALYZER
J. E. UHL 1982 12 p refs Presented at Symp on Instrumentation and Control for Fossil Energy Processes, Houston, Tex., 7 Jun 1982
(Contract DE-AC04-76DP-00789)
(DE82-017032, SAND-82-0214C, CONF-820612-4) Avail: NTIS HC A02/MF A01

A multigas tracer system was designed, built, and used on an explosively fractured oil shale rubble bed. The hardware, software, and overall operation of the tracer system is discussed. This system is a field portable, self contained unit, which utilizes a mass spectrometer for gas analysis. The unit has a 20 channel sample port capability and is controlled by a desk top computer. The system is configured to provide a dynamic sensitivity range of up to six orders of magnitude. A roots blower is manifolded to the unit to provide continuous low in all sample lines. The continuous flow process allows representative samples as well as decreasing the time between each measurement. Typical multiplex cycle time to evaluate four unique gases is approximately 12 seconds. DOE

N83-19877# Sandia Labs., Albuquerque, N. Mex
CONTROLLED SOURCE AUDIO-MAGNETOTELLURIC (CSMAT) RESISTIVITY MEASUREMENTS FOR IN-SITU COMBUSTION
J. R. WAYLAND, D. O. LEE, P. C. MONTOYA, and B. W. MARSHALL 1982 12 p refs Presented at the Ann Heavy Oil Slush EOR Contractors Conf., San Francisco, 27 Jul 1982
(Contract DE-AC04-76DP-00789)
(DE82-016398, SAND-82-1193C, CONF-820712-1) Avail: NTIS HC A02/MF A01

The resistivity changes of an oil bearing formation as a firefront sweeps through were investigated. This information is important to an understanding of the CSAMT apparent resistivity maps made of thermal fronts associated with enhanced oil recovery processes. Resistivity measurements were made in a combustion tube used to simulate in situ combustion recovery. It was found that the resistivity of the formation increased by two decades as the firefront passed through the medium. DOE

N83-19879# Kansas State Univ., Manhattan.
DIFFUSION FLAME STUDIES OF THE CHEMICAL AND PHYSICAL MECHANISMS OF SOOT FORMATION FROM AROMATIC AND SUBSTITUTED AROMATIC FUELS Progress Report, 15 Feb. 1981 - 15 Feb. 1982
T. W. LESTER, J. F. KERKLIN, and C. M. SORENSEN Mar 1982 22 p refs
(Contract DE-AC02-80ER-10677)
(DE82-009310, DOE/ER-10677/2) Avail: NTIS HC A02/MF A01

The development of photon correlation spectroscopy as a soot particle size measurement in flames was pursued. Using both slot diffusion flames doped with benzene and a wick diffusion flame burning kerosene, soot size distributions were determined as a function of height above the base of the flame. Of particular interest was the correct relationship between the particle diffusion coefficient and the particle diameter. Effort was also expanded in extraction of the higher moments of the size distribution from the scattered light spectra. DOE

N83-19881# Illinois Univ., Urbana-Champaign. Dept of Aeronautical and Astronautical Engineering.
FLAME ACCELERATION MECHANISMS UNDER CONDITIONS OF PARTIAL CONFINEMENT Annual Report, Feb. 1981 - Jan. 1982
R. A. STREHLOW, T. W. G. YIP, and B. GHAFARIAN Feb 1982 34 p refs
(PB83-109884; GRI-81/0035; AR-1) Avail: NTIS HC A03/MF A01 CSCL 21D

Two channel apparatus were designed and constructed to study the flame acceleration effects of obstacles with simple geometries placed in a partially confined combustible cloud. Some preliminary experiments were performed. The highest flame speed observed was 7.38 m/sec. The data indicates that, with the appropriate obstacle configurations, higher flame speeds could be observed. The preliminary results also lead to the suspicion that a row of cars in a parking lot or trains could be very dangerous in case of a vapor cloud fire. GRA

N83-19920*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio
HIGH PERFORMANCE LIQUID CHROMATOGRAPHIC HYDROCARBON GROUP-TYPE ANALYSES OF MID-DISTILLATES EMPLOYING FUEL-DERIVED FRACTIONS AS STANDARDS
G. T. SENG and D. A. OTTERSON Mar. 1983 19 p refs
(NASA-TM-83072; E-1544; NAS 115.83072) Avail: NTIS HC A02/MF A01 CSCL 21D

Two high performance liquid chromatographic (HPLC) methods have been developed for the determination of saturates, olefins and aromatics in petroleum and shale derived mid-distillate fuels. In one method the fuel to be analyzed is reacted with sulfuric acid, to remove a substantial portion of the aromatics, which provides a reacted fuel fraction for use in group type quantitation. The second involves the removal of a substantial portion of the saturates fraction from the HPLC system to permit the determination of olefin concentrations as low as 0.3 volume percent, and to improve the accuracy and precision of olefins determinations. Each method was evaluated using model compound mixtures and real fuel samples. Author

N83-19922# Southwest Research Inst., San Antonio, Tex. Mobile Energy Div.
DEGRADATION AND CHARACTERIZATION OF ANTIMISTING KEROSENE (AMK) Final Report, Jul. 1980 - Nov. 1981
R. J. MANNHEIMER Atlantic City, NJ FAA Dec 1982 86 p refs
(Contract DOT-FA79WA-4310)
(MED-132; FAA-CT-82-93) Avail: NTIS HC A05/MF A01

Experiments are described which demonstrate the feasibility of degrading AMK in a single pass with a system consisting of a hydraulic fuel pump from a TF30 engine and several types of flow restrictors such as packed tubes or needle valves. The

04 FUELS AND OTHER SOURCES OF ENERGY

performance of the degraded AMK was evaluated with full-scale aircraft filters (JT8D and CF6), a T63 combustor and laboratory scale tests including filtration, ignition, and gel permeation chromatography. Rheological experiments indicated that while the shear viscosity of AMK increases above a critical shear rate, the magnitude of the shear viscosity is not large enough to explain the effectiveness of the FM-9 additive. However, it was shown that, associated with the critical shear rate, AMK exhibits strong viscoelastic effects that are not evident at low shear rates or in flow through an orifice. Author

N83-19924# Department of Energy, Bartlesville, Okla. Energy Technology Center

MOTOR GASOLINES, SUMMER 1981

E M SHELTON Apr 1982 69 p refs

(DE82-014425, DOE/BETC/PPS-82/1) Avail NTIS HC A04/MF A01

Samples were collected from service stations throughout the country and were analyzed in the laboratories of various refiners, motor manufacturers, and chemical companies. The analytical data for 715 samples of motor gasoline were submitted for study, necessary calculations and compilation. They represent the products of 33 companies, large and small, which manufacture and supply gasoline. These data are tabulated by groups according to brands (unlabeled) and grades for 17 marketing included in this report shows marketing districts into which the country is divided. A map included shows marketing areas, districts and sampling locations. Also included are charts indicating the trends of selected properties of motor fuels since 1959. DOE

N83-19937# Department of Energy, Bartlesville, Okla. Energy Technology Center

LIQUID FOSSIL-FUEL TECHNOLOGY Quarterly Technical Progress Report, Apr. - Jun. 1982

B LINVILLE, ed and D. FUQUA, ed Oct 1982 94 p refs

(DE83-002501, DOE/BETC/QPR-82/2) Avail NTIS HC A05/MF A01

This report primarily covers in-house oil, gas, and synfuel research and lists the contracted research. The report is broken into the following areas: liquid fossil fuel cycle, extraction, processing, utilization, and project integration and technology transfer. BETC publications are listed. DOE

N83-19939# Department of Energy, Pittsburgh, Pa. Energy Technology Center

TRANSPORT CHARACTERISTICS OF ALTERNATE SLURRY FUELS Quarterly Technical Progress Report, Jan. - Mar. 1982

1982 21 p refs

(DE82-013508; DOE/NBM-2013508) Avail NTIS HC A02/MF A01

The transport and handling characteristics of coal-water mixtures (CWM) ranging in coal concentration from 58 to 65% by weight were evaluated. Tests were conducted in a flow loop designed to simulate fuel handling systems typical of industrial boiler applications. The flow system is instrumented to measure line pressure, pressure drop, temperature, and fuel flow rate at a number of points. For the upper limit of the flow rates and for the Pittsburgh steam coal used in these tests, these conditions would represent an average thermal input of roughly 70×10^6 to the 6th power Btu/h. Difficulties encountered in preparing the mixtures are discussed, as are time dependent changes in the effectiveness of the dispersing agents utilized. No attempt was made to prepare specially tailored particle size distributions that might increase the amount of coal in the mixture while maintaining the fluidity of the CWM. Results of the flow tests to date demonstrate the benefits to be gained from the use of dispersants. DOE

N83-19940# Air Products and Chemicals, Inc., Allentown, Pa. **LIQUID-PHASE METHANOL PROCESS DEVELOPMENT UNIT: INSTALLATION, OPERATION, AND SUPPORT STUDIES Technical Progress Report, 1 Jan. - 31 Mar. 1982**

E P. HOLLEY, J. KLOSEK, I C SPECTOR, and R L MEDNICK (Chem Systems, Inc., Tarrytown, NY) 20 Apr 1982 159 p refs

(Contract DE-AC22-81PC-30019)

(DE82-012725, DOE/PC-30019/T2, TPR-2) Avail NTIS HC A08/MF A01

Approval was obtained for the unified design concept, advanced schedule for relocation of the LPM pilot plant, and advanced procurement of long lead delivery equipment items. The LaPorte LPMEOH PDU Process Flowsheet was developed further and the Engineering Flowsheet evolved to the Revision OA preliminary issue. Eight cases of point-by-point heat and mass balances were released. Process equipment specifications were issued for 30 of the 32 equipment items. Mechanical specifications were issued for 16 equipment items. Quotations were received for the 2 long lead delivery items, the Feed/Recycle engineering compressor and the Slurry Circulation Pumps, technical evaluations of these bids are underway. Semi-final equipment arrangement and plot plan drawings were prepared. The Preliminary Hazards Review was conducted and the subsequent Design Hazards Review was initiated. Progress was made on the specification of the Data Acquisition System. APCI established the priority for compositions of new methanol powder catalysts to be prepared. DOE

N83-19941# Institute of Gas Technology, Chicago, Ill. **PIPELINE GAS FROM COAL: HYDROGENATION (IGT HYDROGASIFICATION PROCESS) Final Report, 1 Jul. 1976 - 31 Aug. 1980**

Mar 1982 565 p refs

(Contract DE-AC01-76ET-10163; EF-77-C-012434)

(DE82-014611, DOE/ET-10163/68; FE-2434-68) Avail NTIS HC A24/MF A01

The HYGAS coal gasification program was successfully concluded on August 31, 1980. This report covers operations under US Department of Energy Contract EF-77-C-012434 from July 1, 1976, through August 31, 1980. The primary objective was to provide pilot plant operating data for the design of a commercial/demonstration plant by Procon, Inc., (under a separate DOE contract) and to test process feasibility with a wide variety of bituminous coals. A total of 34 tests were conducted in the pilot plant. A major improvement in reactant gas distribution in the high-temperature steam-oxygen gasifier provided better mixing, more uniform temperatures, and higher carbon conversions without sintering. Commercial/demonstration design support was an integral part of the program. Anticipating the need for actual design data, IGT initiated a program to support the demonstration plant design effort with appropriate pilot plant operating data, technical assistance, data analysis, and process modeling and cold-flow modeling studies of selected areas of the commercial/demonstration plant design. Specific tasks completed under this part of the program are described. DOE

N83-19943# Decision Focus, Inc., Palo Alto, Calif. **INTEGRATED FORECASTING MODEL SYNTHETIC FUELS STUDY. VOLUME 1: OVERVIEW AND FINDINGS Final Report**

R A. MARSHALLA Apr. 1982 161 p refs. Sponsored by Electric Power Research Inst.

(Contract EPRI PROJ 1108-1-4)

(DE82-903574, EPRI/EA-2358-VOL-1) Avail NTIS HC A08/MF A01

The future of a synthetic fuels industry in the United States, with particular emphasis on the consequences for the electric power industry, is assessed. The assessment is based on use of the Integrated Forecasting Model (IFM), a technology based integrated system model of the national energy economy. A series of model scenarios was structured around three key uncertainties bearing on the future of synthetic fuels: synfuels process costs, imported oil prices, and system inertia (an aggregate representation of the effects of institutional and other factors on the maximum rate of

04 FUELS AND OTHER SOURCES OF ENERGY

market penetration of a new technology once it becomes economically attractive). DOE

N83-19944# Illinois State Univ., Normal
ENERGY-EFFICIENT ALCOHOL-FUEL PRODUCTION Technical Final Report

Jan 1982 15 p
(Contract DE-FG02-81AF-92006)
(DE82-011278, DOE/AF-92006/T1) Avail NTIS HC A02/MF A01

The proposed utilization schedule for the alcohol fuel plant and methane generator is to produce 180 proof ethanol during the spring, summer, and fall (April to October). The ethanol will be used in the farm tractors and trucks during the planting, growing, and harvesting seasons. Some alcohol can be stored for use during the winter. The still will not be operated during the winter (November to March) when the methane from the digester will be used to replace fuel oil for heating a swine farrowing building. There are tentative plans to develop a larger methane generator, which will utilize all of the manure (dairy, beef, horses, and swine) produced on the ISU farm. If this project is completed, there will be enough methane to produce all of the alcohol fuel needed to operate all of the farm equipment, heat the buildings, and possibly generate electricity for the farm. The methane generating system developed is working so well that there is a great deal of interest in expanding the project to where it could utilize all of the livestock waste on the farm for methane production. DOE

N83-19945# Oak Ridge National Lab., Tenn Fossil Energy Information Center

PUBLICATIONS IN LIFE SCIENCES SYNTHETIC FUELS OF OAK RIDGE NATIONAL LABORATORY

L. W. RICKERT, comp Oct 1982 55 p refs
(Contract W-7405-ENG-26)
(DE83-001701, ORNL/TM-7680-S1) Avail NTIS HC A04/MF A01

The list represents the principal elements of the Life Sciences Synthetic Fuels Program, namely: (1) characterization, measuring, and monitoring research to develop sampling and analytical techniques and surveillance instrumentation; (2) industrial hygiene efforts to identify and monitor potential health hazards to employees; (3) biological studies centered on the identification and screening of potentially hazardous materials and assessment of dose-response relationships for chronic or acute exposures; (4) environmental transport analyses to investigate material dispersion, reconcentration, and impact on biological communities; (5) environmental control research to develop techniques for effluent and emission reduction; and (6) assessments concerned with optimizing plant siting and operation through development and applications of methods for risk analysis. Publications are listed by author and in a permuted title index. DOE

N83-19946# Institute of Gas Technology, Chicago, Ill
GASIFICATION OF LAND-BASED BIOMASS Annual Report, Jan. - Dec. 1981

D. E. JERGER, H. S. GHOSH, D. Q. TRAN, and S. BABU Sep 1982 204 p refs
(PB83-109918; GRI-81/0080) Avail NTIS HC A10/MF A01
CSCL 21D

Research to develop efficient processes for conversion of land-based biomass to methane and other resources is described. One activity involved screening a variety of species to evaluate their reactivity under conditions of biological and thermal gasification. The second activity included advanced biogasification experiments on water hyacinth/sludge blend to optimize methane yields, production rates, and process stability through pretreatment and advanced reactor configurations designed to increase solids and microbial residence times. An anaerobic biogasification potential bioassay was refined and applied to several herbaceous and woody species. Methane yields in the range of 4-6 SCF/lb VS added were obtained for most herbaceous and several woody species. These yields are substantially higher than reported previously for conventional digestion of these feeds. Of several

pretreatment techniques evaluated, sodium hydroxide treatment resulted in improved methane yields with cotton gin trash and improved rates with cotton gin trash and woody species. GRA

N83-19998# National Bureau of Standards, Boulder, Colo
Electromagnetic Fields Div
DEVELOPMENT OF HIGH FREQUENCY ELECTROMAGNETIC MAPPING (HFEM) TECHNOLOGY Final Report

R. L. JESCH Apr 1982 93 p refs
(Contract DE-AC20-80LC-10417)
(DE82-012773, DOE/LC-10417/T1) Avail NTIS HC A05/MF A01

High frequency electromagnetic mapping (HFEM) techniques were developed for evaluating rubblized oil shale in the cold retort state in the modified in situ process. This technology development is also applicable for using HFEM techniques for diagnosing, monitoring, controlling and evaluating modified in situ retorts after they are ignited. The baseline data work required to design a high temperature sample holder and experiments for determining the EM properties of oil shale samples at elevated temperatures (200 to 500 C) are described. A theoretical approach is given for modeling oil shale retorts for electromagnetic sensing techniques by a spheroid with an average dielectric constant along with numerical results. Finally, the measurement results are given for the spent and raw shale samples that were obtained from portions of the ten half score samples plus the results of the electromagnetic transmission measurements taken on oil shale samples. DOE

N83-20073# Central Inst. for Industrial Research, Oslo (Norway)
Oil and Energy Dept

WAVE MODEL: A NUMERICAL MODEL FOR THE FRICTIONAL ABSORPTION OF WATER WAVES

G. HUTTON 10 Oct 1981 37 p refs
(PB83-100792; ISBN-82-7267-397-5, REPT-78-04-09-8) Avail NTIS HC A03/MF A01 CSCL 20D

This report describes a numerical model used to calculate the frictional absorption of power in water waves. An example of a power conversion channel is given and the model is compared to some experimental results. Author (GRA)

N83-20171# Oregon State Univ., Corvallis
EFFECT OF LOW-PROOF ALCOHOL FUMIGATION-FUELING ON CRANKCASE OIL DILUTION IN A DIESEL-CYCLE ENGINE Final Report

J. G. MINGLE and D. J. BUSHNELL Nov 1982 39 p refs
(Contract DE-AS19-81BC-10449)
(DE83-002976, DOE/BC-10449/1) Avail NTIS HC A03/MF A01

A turbocharged diesel engine was converted to a dual fuel engine in which ethyl alcohol was fumigated between the turbocharger and the intake manifold, and the diesel fuel was injected normally at a reduced rate. The occurrence of crankcase oil dilution and its cause was examined by the following independent parameters: proof of the ethyl alcohol, crankcase oil temperature, engine load at maximum torque speed, and percentage of total energy in the form of ethyl alcohol. Engine tests were steady state for 6 hours, after which the crankcase oil was sampled for determination of flash points and fire points, water by centrifuge, water by distillation, and viscosity at room temperature. A decrease in thermal efficiency and an increase in exhaust carbon monoxide as the percentage of total energy as alcohol is increased is found. A decrease in flash points and fire points, and a decrease in viscosity of the lubricating oils as the percentage of total energy as alcohol is increased is also shown. It is noted that there was no apparent structural damage to the engine during the testing. DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-20330# SRI International Corp, Menlo Park, Calif **REVIEW OF THAWTRON DEVICE FOR THAWING FROZEN COAL Final Report**

W A. EDSON and G E. TALLMADGE Mar 1982 87 p refs
Sponsored by DOE and Electric Power Research Inst.
(DE82-903145, EPRI-CS-2253) Avail. NTIS HC A05/MF A01

The use of microwave energy to thaw frozen coal and the THAWTRON device, which was proposed for this purpose are discussed. Microwave and thermal properties of coal and other materials are reviewed as a guide to the feasibility of the proposed method. Microwave thawing is compared with mechanical devices, radiant heaters, and freeze conditioning agents as an aid to unloading cars of frozen coal. It is concluded that development of a full size THAWTRON device involves high technical risk and that microwaves are unlikely to be cost effective in comparison to other available techniques for unloading frozen coal. DOE

N83-20333# Department of Energy, Bartlesville, Okla Energy Technology Center

BARTLESVILLE ENERGY TECHNOLOGY CENTER ENHANCED OIL RECOVERY PROJECT DATA BASE

Mar 1982 88 p
(DE82-012568, DOE/BETC-SP-82/6) Avail. NTIS HC A05/MF A01

The BETC Enhanced Oil Recovery Data Base is currently being developed to provide an information resource to accelerate the advancement and applications of EOR technology. The primary initial sources of data have been the Incentive and Cost-Shared Programs. The data base greatly contains information on 607 EOR projects. This includes 410 of the approximately 423 projects which operators originally applied for certification with the Incentive Program, 20 EOR projects under the Cost-Shared Program, and a data base relating to 177 projects developed by Gulf Universities Research Consortium. In addition, relevant data from all previous DOE-funded contractor EOR data bases will be integrated into the BETC data base. Data collection activities from publicly available information sources is continuing on an on-going basis to insure the accuracy and timeliness of the information within the data base. The BETC data base is being developed utilizing a commercial data base management system. DOE

N83-20337# Bendix Field Engineering Corp, Grand Junction, Colo.

PLTSYM: A FORTRAN COMPUTER SYSTEM TO PLOT CANADIAN SYMBOL LOCATION MAPS FOR HYDROGEOCHEMICAL AND STREAM-SEDIMENT RECONNAISSANCE DATA

R. J. ZINKL, D. L. SHETTEL, JR., and R. F. DANDREA, JR. Sep 1982 141 p refs
(Contract DE-AC13-76GJ-01664)
(DE83-000764; GJBX-193-82) Avail. NTIS HC A07/MF A01

The PLTSYM system plots sample location maps on a line plotter at virtually any scale with data point values represented by one of 15 Canadian symbols. Sample location data can be in latitude/longitude or (X,Y) coordinate form. Five map projections are available for converting latitude/longitude into easting/northing coordinates. Data values can be sorted into classes using any one of four different class interval options. DOE

N83-20342# Foersvarets Forskingsansalt, Stockholm (Sweden) **THE IMPORTANCE OF SATISFACTORY POSITIONING, DIVING AND MAPPING SYSTEMS SUITABLE FOR EXPLORATION AND TRANSPORTATION IN ICECOVERED SEA AREAS**

R. TOREN Aug 1982 68 p refs
(PB83-109587, FOA-B-60003-M7, ISBN-91-7056-063-3) Avail. NTIS HC A04/MF A01 CSDL 08L

In an introductory chapter (1) the author presents a general view of the remarkable evolution of the remote sensing technique during the last decades, all of great importance for operations in more or less ice-covered sea areas, especially at the exploration of natural resources, such as oil, gas and minerals, and at surface shipping as well as under-ice navigation. In all cases the best possible position-fixing and a true knowledge of the bathymetry

and prevailing ice conditions are necessary. Also included in the report are chapters on Exploration of the Arctic Ocean, Underwater Pingoes, Offshore Permafrost and Ground ice, and Underwater Technology. GRA

N83-20361*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

CRITICAL RESEARCH AND ADVANCED TECHNOLOGY (CRT) SUPPORT PROJECT Summary Report

E. R. FURMAN, D. N. ANDERSON, P. E. HODGE, C. E. LOWELL, J. J. NAINIGER, and D. F. SCHULTZ Feb 1983 58 p refs
(Contract DE-AI01-77ET-10350)

(NASA-TM-83019, E-1455, DOE/NASA/10350-35, NAS 115 83019) Avail. NTIS HC A04/MF A01 CSDL 10A

A critical technology base for utility and industrial gas turbines by planning the use of coal-derived fuels was studied. Development tasks were included in the following areas: (1) Combustion - investigate the combustion of coal-derived fuels and methods to minimize the conversion of fuel-bound nitrogen to NO_x; (2) materials - understand and minimize hot corrosion; (3) system studies - integrate and focus the technological efforts. A literature survey of coal-derived fuels was completed and a NO_x emissions model was developed. Flametube tests of a two-stage (rich-lean) combustor defined optimum equivalence ratios for minimizing NO_x emissions. Sector combustor tests demonstrated variable air control to optimize equivalence ratios over a wide load range and steam cooling of the primary zone liner. The catalytic combustion of coal-derived fuels was demonstrated. The combustion of coal-derived gases is very promising. A hot-corrosion life prediction model was formulated and verified with laboratory testing of doped fuels. Fuel additives to control sulfur corrosion were studied. The intermittent application of barium proved effective. Advanced thermal barrier coatings were developed and tested. Coating failure modes were identified and new material formulations and fabrication parameters were specified. System studies in support of the thermal barrier coating development were accomplished. Author

N83-20365# Committee on Science and Technology (U. S. House).

THE NATURAL GAS OPTION. NEW RESOURCES AND NEW TECHNOLOGIES

Washington GPO 1982 233 p. Hearing before the Subcomm on Energy Develop and Appl of the Comm. on Sci and Technol., 97th Congr, 2d Sess, 30 Jul 1982
(GPO-99-979) Avail: Subcommittee on Energy Development and Applications

Unconventional and traditional resources of natural gas, the technological needs of the industry to develop these resources, and the impact of price fluctuations on their production plans and on the future growth of the natural gas industry are discussed. The advantages and disadvantages of accelerated natural gas and oil production are also discussed. Author

N83-20366# Committee on Science and Technology (U. S. House)

COAL RESEARCH

Washington GPO 1982 448 p refs. Hearings before the Subcomm on Energy Develop and Appl of the Comm on Sci and Technol, 97th Congr, 2d Sess, 18 May, 21 Jun, 23 Aug and 16 Sep. 1982
(GPO-99-879) Avail: Subcommittee on Energy Development and Applications

Coal research is discussed. National scientific skills available to coal research are inventoried, achievements are assessed, and the Federal role is determined. Author

04 FUELS AND OTHER SOURCES OF ENERGY

N83-20383# Ames Lab, Iowa

FOSSIL-ENERGY Quarterly Report, 1 Oct. - 31 Dec. 1981

J. E. BENSON, R. A. JACOBSON, D. L. BIGGS, D. BIRLINGMAIR, R. FISHER, W. E. STRASZHEIM, C. G. VENIER, and T. G. SQUIRES May 1982 34 p

(Contract W-7405-ENG-82)

(DE83-003817, IS-4801) Avail NTIS HC A03/MF A01

Objectives and progress in the areas of the fossil energy program are reported. The following subjects were studied: the mineral content of coal and the development of an online monitoring instrument, ashing properties of coal blends, coal preparation and testing, coal microcharacterization (trace elements), and chemical evaluation of the gravimelt process DOE

N83-20386# Department of Energy, Washington, D. C.

MATERIALS FOR COAL CONVERSION AND UTILIZATION

1981 575 p refs 6th Ann. Conf held in Gaithersburg, Md, 13-16 Oct 1981, sponsored by DOE, EPRI, Gas Research Inst, and NBS

(DE82-013244, CONF-811061) Avail NTIS HC A24/MF A01

The Sixth annual conference on materials for coal conversion and utilization was held October 13-15, 1981 at the National Bureau of Standards Gaithersburg, Maryland. It was sponsored by the US Department of Energy, the Electric Power Research Institute, the Gas Research Institute and the National Bureau of Standards. Fifty-eight papers from the proceedings have been entered individually into EDB and ERA; four papers have been entered previously from other sources (LTN) DOE

N83-20395# Battelle Columbus Labs, Ohio

THE UTILIZATION OF EMERGENT AQUATIC PLANTS FOR BIOMASS-ENERGY-SYSTEMS DEVELOPMENT

S. KRESOVICH, C. K. WAGNER, D. A. SCANTLAND, S. S. GROET, and W. T. LAWHON Feb 1982 113 p refs Prepared in cooperation with Midwest Research Inst., Golden, Colo

(Contract DE-AC02-77CH-00178)

(DE82-009174, SERI/TR-98281-03) Avail NTIS HC A06/MF A01

A review was conducted of the available literature pertaining to the following aspects of emergent aquatic biomass: identification of prospective emergent plant species for management, evaluation of prospects for genetic manipulation, evaluation of biological and environmental tolerances; examination of current production technologies; determination of availability of seeds and/or other propagules, and projections for probable end-uses and products. Species identified as potential candidates for production in biomass systems include *Arundo donax*, *Cyperus papyrus*, *Phragmites communis*, *Saccharum spontaneum*, *Spartina alterniflora*, and *Typha latifolia*. If these species are to be viable candidates in biomass systems, a number of research areas must be further investigated. Points such as development of baseline yield data for managed systems, harvesting conceptualization, genetic (crop) improvement, and identification of secondary plant products require refinement DOE

N83-20406# Argonne National Lab., Ill

PROCEEDINGS OF THE 1981 SYMPOSIUM ON INSTRUMENTATION AND CONTROL FOR FOSSIL-ENERGY PROCESSES

Jan 1982 856 p refs Symp. held in San Francisco, Calif, 8-10 Jun 1981

(Contract W-31-109-ENG-38)

(DE82-011999, ANL-81-62; CONF-810607) Avail NTIS HC A99/MF A01

Advances in the state of the art in instrumentation and control for fossil energy processes are presented. Temperature monitoring techniques, coal analysis techniques, and flow measurement methods are discussed together with process control and sampling and analysis. Environment and industrial hygiene considerations are also addressed. Emphasis is placed on increased importance of instrumentation and control techniques within the synthetic fuels industry BG

N83-20414# California Univ, Berkeley. Lawrence Berkeley Lab. Energy and Environment Div

DIRECT LIQUEFACTION OF BIOMASS: RESULTS FROM OPERATION OF CONTINUOUS BENCH SCALE UNIT IN LIQUEFACTION OF WATER SLURRIES OF DOUGLAS FIR WOOD

L. L. SCHALEGER, C. FIGUEROA, and H. G. DAVIS May 1982 27 p refs Presented at the 4th Symp on Biotechnol in Energy

Production and Conservation, Gatlinburg, Tenn, 11-14 May 1982

(Contract W-7405-ENG-48, DE-AC06-76RL-01830;

DE-AC03-76SF-00098, DE-AC06-76LO-1830)

(DE82-015703, LBL-14019, CONF-820580-1) Avail NTIS HC A03/MF A01

A continuous liquefaction unit (CLU) is discussed. The operation was single pass, feeding water slurries of prehydrolyzed Douglas fir wood (LBL process). Significant differences from results with the oil slurry, high oil, and water recycle process (PERC process) were found. The LBL process, at practicable temperatures and residence times, makes somewhat less wood oil and considerably more water-soluble product than does PERC. Consumption of carbon monoxide in LBL, other than by water gas shift reaction, is minimal, as opposed to several tenths of a mole per 100 grams of wood in PERC. Replacement of carbon monoxide with hydrogen as reactant gas makes little or no difference in yield distribution or product analysis. Progress in characterizing the oil and water-soluble product, the overall stoichiometry of the LBL and PERC processes, and the role of formate ion are described GRA

N83-20415# Wright-Malta Co., Ballston Spa, N. Y.

CATALYZED STEAM GASIFICATION OF BIOMASS. PHASE 3: BIOMASS PROCESS DEVELOPMENT UNIT (PDU) CONSTRUCTION AND INITIAL OPERATION

J. J. HEALEY and R. H. HOOVERMAN Dec. 1981 81 p

(Contract DE-AC02-78ET-23025)

(DE82-010264, DOE/ET-23025/26) Avail NTIS HC A05/MF A01

The design and construction of the process development unit (PDU) are described in detail, examining each system and component in order. Siting, the chip handling system, the reactor feed system, the reactor, the screw conveyor, the ash dump system, the PDU support equipment, control and information management, and shakedown runs are described. DOE

N83-20418# Midwest Research Inst., Golden, Colo. Biotechnology Research Branch

DEVISING EFFICIENT BIOTECHNOLOGICAL PROCESSES FOR THE PRODUCTION OF FUELS AND CHEMICALS FROM BIOMASS Annual Report for FY 1981

R. VILLET May 1982 158 p refs

(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)

(DE82-017089; SERI/PR-232-1511) Avail NTIS HC A08/MF A01

Research directed toward improving ethanol processes based on readily fermentable feedstocks is discussed. Efforts were also made to develop novel fermentation systems. Reducing the cost of producing ethanol and other chemicals requires using cellulose as feedstocks, which when hydrolyzed form hexose sugars readily metabolized by yeast. A program was undertaken to discover thermophilic organisms that convert various biopolymers to ethanol and other chemical products. Lipids suitable as diesel oil extenders are produced by microorganisms. A screening program was undertaken to identify microbial strains with a biotechnological potential. This involved a precise, quantitative chemical analysis of lipid products. Some work on developing a 2,3-butanediol fermentation process is described. During the fermentation process ethanol is also produced. To improve the ratio of butanediol to ethanol, a program of genetic and physiological research was designed and initiated. DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-20434# Idaho National Engineering Lab., Idaho Falls.
STATUS OF DOE SMALL HYDROPOWER RESEARCH AND DEVELOPMENT PROJECTS

E. H. MAGLEBY, ed., B. N. RINEHART, ed., and J. R. CHAPPELL, ed. Oct 1982 26 p refs
 (Contract DE-AC07-76ID-01570)
 (DE83-001353; EGG-HYD-6024) Avail NTIS HC A03/MF A01

The results and the status of small hydropower R and D projects are presented. Also included is an updated bibliography of completed reports. In most cases, reports are published to make available the research, engineering, operating, regulatory or cost information from the projects that are pertinent to hydropower development by private and nonfederal government sectors.

DOE

N83-20440# General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept.
SNG FROM LAND-BASED BIOMASS 1981 PROGRAM Final Report, Jul. - Dec. 1982

K. JAIN, B. RUDDY, and R. MAKINEN. Jan. 1982 123 p refs
 Sponsored by Gas Research Inst.
 (PB83-10467; GRI-81/0031) Avail NTIS HC A06/MF A01
 CSDL 07A

The planning and systems analysis aspects for developing regional commercial scale methane production systems are discussed. The interim results presented include a preliminary program plan, a review of literature data on two system concepts, and a description of the system analysis methodology. One methane production concept is based on anaerobic digestion of a sorghum based feedstock and the other on thermal gasification of hybrid poplar. System studies on the production and conversion of the two feedstocks are reviewed.

GRA

N83-20479# Army Cold Regions Research and Engineering Lab., Hanover, N. H. Geotechnical Research Branch.
SUBSEA PERMAFROST IN HARRISON BAY, ALASKA: AN INTERPRETATION FROM SEISMIC DATA

K. G. NEAVE and P. V. SELLMANN. Aug 1982 65 p refs
 Sponsored in part by the Bureau of Land Management and the National Oceanic and Atmospheric Administration
 (AD-A121020; CRREL-82-24) Avail. NTIS HC A04/MF A01
 CSDL 08L

Velocity data derived from petroleum industry seismic records from Harrison Bay show that high-velocity material ($>$ or $=$ 2 km/s) interpreted to be ice-bonded permafrost is common. In the eastern part of the bay, the depth to high velocity material increases and velocity decreases in an orderly manner with increasing distance from shore until the layer is no longer apparent. The western part of the bay is less orderly, possibly reflecting a different geological and thermal history. This western part may be an inundated section of the low coastal plain characterized by the region north of Teshekpuk Lake, and could have contained deep thaw lakes, creating low velocity zones. Along some seismic lines, the high-velocity material extends approximately 25 km offshore. Two anomalies have been found which could be associated with rapidly degrading permafrost. One is strong attenuation, which was interpreted as an indication of gas in the shallow deposits. The other is the presence of considerable seismic noise, including identifiable small seismic events. The origin of this noise has not been positively established, and it is proposed that it may indicate that some movement is occurring in the sediments due to thaw.

GRA

N83-21051# Central Electricity Generating Board, London (England)

DESULPHURISATION OF SOLID FUELS IN POWER STATIONS BY SUPERCONDUCTIVE MAGNETS

H. DOERR, F. P. MONOSTORY, and M. SEIDL. 26 Nov. 1982 21 p refs. Transl into ENGLISH from Glueckauf (West Germany), v. 117, no. 17a, 1981 p 11-17
 (BLL-CE-TRANS-7855-(9022 09)) Avail. British Library Lending Div., Boston Spa, Engl.

Desulphurization of solid fuels in power station by superconductive magnets was studied. A superconductive strong field magnetic separator was interated in the inner grinding circuit of a coal mill as a dry process for the physical mineral and pyrite separation from power station coal. Further development work is required to make the process suitable for customary plant sizes. The process cannot replace, but only assist desulphurization of the flue gases in the case of coal with over 0.6% organic sulphur/tce even with an emission value of 3.75 kg SO₂/MWh. Depending on the sulfur or pyrite content of the power station coal supplied, the efficiency and costs of flue gas desulphurization and the limit value of the permissible SO₂ emission, the combination of pulverized coal and flue gas desulphurization may be economically advantageous in limiting cases.

S.L.

N83-21052# Bonn Univ. (West Germany) Inst fuer Physikalische.

FUNDAMENTAL RESEARCH ON FISCHER-TROPSCH SYNTHESIS Final Report, Jul. 1981

M. RITSCHEL, H. W. BUSCHMANN, and W. VIELSTICH. Bonn Bundesministerium fuer Forschung und Technologie. Jan 1982 108 p refs. In GERMAN, ENGLISH summary
 (BMFT-FB-T-82-020, ISSN-0340-7608) Avail. NTIS HC A06/MF A01

At the present state of knowledge a detailed comparison of the different processes of coal refining cannot be carried out. The economics of the Fischer-Tropsch synthesis highly depends on the enhancement of products of technical interest as C₂-C₄ olefines. To get new insights into the mechanism of the Fischer-Tropsch (F.T.) reaction and the distribution of its reaction products on their C numbers investigation of the F.T. synthesis in a laboratory scale reactor, the hydrogenation and the hydrolysis of F.T. catalysts, and the adsorption and desorption of reactands and intermediates were conducted. The investigation resulted in the formulation of a reaction mechanism involving carbidic C atoms. From this mechanism the distribution of the reaction products can be deduced. The validity of this mechanism is demonstrated by the analysis of numerous F.T. product spectra.

Author

N83-21053# STEAG A.G., Essen (West Germany)
FLUE GAS DESULFURIZATION WITH WASTE WATER EVAPORATION. PHASE 2: OBSERVATION OF THE EXPERIMENTS AT WEIHER II Final Report, Jul. 1981

H. BRAUWEILER, R. KARGER (Vereinigte Elektrizitaetswerke Westfalen AG), and U. STARKE (Vereinigte Elektrizitaetswerke Westfalen AG). Bonn Bundesministerium fuer Forschung und Technologie. Mar 1982 20 p. In GERMAN; ENGLISH summary
 (BMFT-FB-T-82-026, ISSN-0340-7608; BMFT-03E1148A/ETS6004) Avail. NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 4,20

A process for cleaning flue gases with high chloride content from coal fired power plants was tested. Dealing with a comparison of processes, 'Reduction of sulfur dioxide emission, choice of flue gas desulfurization process', indicated that the SHU process has a certain potential especially with regards to reducing the amount of waste water. The anticipated advantage has to be proven by pilot scale testing followed by industrial scale trial. The results of the R+D project show that operation with 25% per weight of CaCl₂ is feasible with regard to desulfurization and oxidation. The appreciable lowering of waste water is, however, only possible when the quality requirement of gypsum with respect to the Cl(-) content is decreased.

S.L.

04 FUELS AND OTHER SOURCES OF ENERGY

N83-21054# Saarbergwerke A.G. Saarbrueken (West Germany) Hauptabteilung Forschung und Entwicklung
ENLARGEMENT OF THE RAW MATERIAL BASIS OF REFINERIES BY INCLUDING HARD COAL: PILOT PLANT FOR COAL HYDROGENATION, CONSTRUCTION PHASE Final Report, Apr. 1982

R. LODES, B. LOHR, A. OLEOWNIK, and K. REIFARTH Bonn Bundesministerium fuer Forschung und Technologie Nov. 1982 58 p In GERMAN; ENGLISH summary (BMFT-FB-I-82-192, ISSN-0340-7608) Avail: NTIS HC A04/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 12

The design, construction and commissioning of a pilot plant for direct coal hydrogenation with a maximum coal throughput of 6 t/d is discussed. This plant is based on the proven IG-process. The design data for the modified process was experimentally obtained during laboratory scale investigations, including newly introduced process steps. Author

N83-21068# Montana State Univ., Bozeman. Dept. of Chemical Engineering.

CATALYTIC HYDROGENATION OF COAL-DERIVED LIQUIDS Interim Report, Jun. - Sep. 1982

L. BERG and F. P. MCCANDLESS Dec. 1982 42 p (Contract DE-AC22-76ET-10495; EX-76-C-01-2034) (DE83-003582; DOE/ET-10495/28, FE-2034-28) Avail: NTIS HC A03/MF A01

The quantitative effect of pressure and temperature on the denitrogenation, desulfurization and conversion to gasoline and naphtha of solvent refined coal (SRC)-2 by catalytic hydrotreating-hydrocracking was demonstrated by varying both pressure and temperature during a single continuous run. Improved performance in each respect was attained at the higher pressure and temperature. Three different catalysts and three different ratios were evaluated to determine whether a partially hydrogenated heavy creosote would act as a donor solvent in the upgrading of SRC-2. Only one condition gave increased denitrogenation but not enough improvement to compensate for the extra effort involved. Seven combinations of cobalt, molybdenum, nickel and tungsten on an alumina base carrier were evaluated to determine the combination best suited to the upgrading with water addition. The catalysts were evaluated relative to their ability to denitrogenate, desulfurize and convert the SRC-2 to gasoline, middle distillate and heavy oils. DOE

N83-21069# Department of Energy, Morgantown, W. Va. Advanced Gasification Section.

ADVANCED GASIFICATION PROJECTS

Feb. 1982 77 p refs (DE83-003616; DOE/METC-SP-188) Avail: NTIS HC A05/MF A01

An analysis of the needs for coal gasification reveals the following principal categories of information gaps that can be filled by programs already in progress or those readily initiated. The gaps are technology base needs required for successful application of both currently available and advanced gasification processes. The need areas are classified as follows. Reactor design/performance, gas cleaning/cooling separation, acid-gas removal/gas shift/gas conversion, wastewater treatment, and general data base on both state-of-the-art and advanced technologies. During the future operating and optimization phases of most of the coal gasification projects, when additional troubles will surface, the technical support program described will have provided the additional data base needed to correct deficiencies and/or to advance the state-of-the-art. US DOE supported projects in this area are described. DOE

N83-21071# State Univ. of New York, Binghamton. Dept. of Chemistry.

DESULFURIZATION WITH TRANSITION METAL CATALYSTS

J. J. EISCH 1 Nov 1982 5 p refs (Contract DE-FG22-81PC-40782) (DE83-003062, DOE/PC-40782/T3) Avail: NTIS HC A02/MF A01

The principal objective was to uncover new reagents and catalysts for upgrading coal-derived fuels by removing undesirable organosulfur, organonitrogen and, if feasible, organooxygen components. The following studies were continued or initiated: study of the combined desulfurizing action of nickel salts and metal hydrides, either in homogeneous media or when dispensed on a silica or polymer support; evaluation of phosphine complexes of nickel or molybdenum as potent desulfurizing agents; examination of the desulfurizing action of nickel and cobalt salts, when combined with aluminum hydrides, toward sulfones and sulfides; adaptation of nickel and cobalt agents for the desulfurization of solvent refined coal liquids; and continued search for similar agents that could denitrogenate carbazoles and quinolines. DOE

N83-21076# Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Technology Div.

LOW-TEMPERATURE PYROLYSIS OF COAL TO PRODUCE DIESEL-FUEL BLENDS

T. B. SHAFER, O. J. JETT, and J. S. WU Oct 1982 58 p refs (Contract W-7405-ENG-26) (DE83-001637; ORNL/MIT-355) Avail: NTIS HC A04/MF A01

Low temperature (623 to 7730 K) coal pyrolysis was investigated in a bench scale retort. Factonally designed experiments were conducted to determine the effects of temperature, coal particle size, and nitrogen flow rate on the yield of liquid products. Yield of condensable organic products relative to the proximate coal volatile matter increased by 3.1 and 6.4 wt% after increasing nitrogen purge flow rate from 0.465 to 1.68 L/min and retort temperature from 623 to 7230 K, respectively. The liquid product may be suitable for blending with diesel fuel. The viscosity and density of coal liquids produced at 7230 K were compared with those of diesel fuel. The coal liquids had a higher carbon to hydrogen ratio and a lower aliphatic to aromatic ratio than premium quality No. 2 diesel fuel. It was recommended that liquids from coal pyrolysis be blend in internal combustion engines. DOE

N83-21077# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.

PARTIAL LIQUEFACTION OF COAL BY FLASH HYDROPYROLYSIS Final Technical Report

C. L. OBERG, A. Y. FALK, D. R. KAHN, and L. P. COMBS 20 Sep 1982 222 p refs (Contract DE-AC22-76ET-10144; EX-76-C-01-2044) (DE83-001145; ESG-DOE-13384; FE-2044-52) Avail: NTIS HC A10/MF A01

Routine reactor operation with caking western Kentucky bituminous coals was established. Overall carbon conversions typically were in the 55% to 65% range. Carbon conversion to liquid hydrocarbons ranged between 30% to 40%, typically, with as much as 11% carbon conversion to BTX aromatics. Good progress was made toward characterizing the quality and properties of the liquid product. Most of the remaining converted carbon was high value gases (e.g., CH₄, CO, C₂H₄, C₂H₆) useful as pipeline SNG and chemical plant feed stocks. The unconverted carbon was collected as a fine granular dry char suitable for direct feeding to a partial oxidation coal/char gasifier for hydrogen production. The commercial potential of flash hydroliquefaction was assessed. A 74% potential overall thermal efficiency and an average product selling price lower than those estimated for several competing coal liquefaction processes. DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-21078# State Univ. of New York, Buffalo. Dept. of Chemical Engineering.

CATALYTIC COAL LIQUEFACTION Final Report

S. W. WELLER 1981 55 p refs

(Contract DE-AC22-76ET-10518)

(DE83-001098; DOE/ET-10518/T4) Avail: NTIS HC A04/MF A01

Monolith catalysts of $\text{MoO}_3\text{-CoO-Al}_2\text{O}_3$ were prepared and tested for coal liquefaction in a stirred autoclave. The O_2 chemisorption and BET surface area were measured on a series of $\text{Co/Mo/Al}_2\text{O}_3$ catalysts derived from Cyanamid 1442A. Some $\text{MoO}_3\text{-Al}_2\text{O}_3$ catalysts over the loading range 3.9 to 14.9 wt % MoO_3 were studied with respect to BET surface (before and after reduction), O_2 chemisorption at -780°C , redox behavior at 5000°C , and activity for cyclohexane dehydrogenation at 5000°C . The relative thermodynamic stability of SnCl_2 , Sn , SnO_2 , and SnS in the presence of H_2 , HCl , H_2S and H_2O was calculated. Ferrous sulfate dispersed in methylnaphthalene reduced to ferrous sulfide under typical coal hydrolquefaction conditions. This suggests that ferrous sulfide may be the common catalytic ingredient when either ferrous sulfate impregnated on powdered coal, or finely divided iron pyrite is used as the catalyst. DOE

N83-21079# Department of Energy, Washington, D. C. Energy Information Administration

SURVEY OF LARGE COMBUSTORS: ALTERNATIVE FUEL BURNING CAPABILITIES OF LARGE BOILERS IN 1979

12 Feb. 1982 26 p refs

(DE82-008386; DOE/EIA-0304) Avail: NTIS HC A03/MF A01

Data are summarized from a survey of 6647 large industrial boilers which were actually in operation during the 1979. These boilers consumed a total of 4433.4 trillion Btu of purchased and nonpurchased fuels. Of this amount, 1382.5 trillion Btu or 31% was natural gas. Consumption of fuel oil, coal, pulping liquor, and waste gases was considerably smaller, ranging from 536.7 trillion Btu to 786.3 trillion Btu. Alternative-fuel burning capabilities were reported for 4598 of these boilers (70%); these consumed a total of 3461.8 trillion Btu of fuel. Most of these boilers (3683) had the capability of burning natural gas as one of the alternative fuels. The most common alternative-fuel burning capability was natural gas and fuel oil (2256 boilers). The second most common was natural gas, fuel oil, and one or more other fuels not including coal (685 boilers). There is widespread capability to burn either natural gas or fuel oil in the respondent's reported boilers. DOE

N83-21083# Oak Ridge National Lab., Tenn.

ENGINEERING SYSTEMS ANALYSIS OF PRESSURIZED FLUIDIZED-COMBUSTION POWER SYSTEMS

R. L. GRAVES, F. P. GRIFFIN, and M. E. LACKEY. Apr. 1982 213 p refs

(Contract W-7405-ENG-26)

(DE82-013390, ORNL/TM-8136) Avail: NTIS HC A10/MF A01

Data for the research and development program on pressurized fluidized bed combustor (PFBC) systems is provided. A broad review of PFBC technology and an analysis to determine its potential and sensitivity to key development needs is presented. Background information pertaining to the application of PFBC to the market for coal fired technology is included. The status of development is reviewed and the deficiencies in data are identified. Responses to a survey of PFBC developers are reviewed with emphasis on the high risk areas of the PFBC concept. Some of these problems are: uncertainty of life of gas turbine components; lack of demonstration of load following, and hot solids handling. Some high risk areas, such as the gas cleanup or gas turbine systems, can be relieved by reducing the severity of design conditions such as the turbine inlet temperature. DOE

N83-21084# Pacific Northwest Lab., Richland, Wash.

COMBUSTION OF OIL ON WATER: AN EXPERIMENTAL PROGRAM Final Technical Report

W. WAKAMIYA, S. E. PETTY, A. BOIARSKI, and A. PUTNAM Feb. 1982 95 p refs

(Contract DE-AC06-76RL-01830)

(DE82-014598, PNL-3568; DOE/NBM-1002) Avail: NTIS HC A05/MF A01

How well crude and fuel oils burn on water was determined. Objectives were: (1) to measure the burning rates for several oils; (2) to determine whether adding heat improves the oils' combustibility; (3) to identify the conditions necessary to ignite fuels known to be difficult to ignite on ocean water (e.g., diesel and Bunker C fuel oils); and (4) to evaluate the accuracy of an oil burning model. Observations were made about how weathering and the thickness of the oil layer affect the combustion of crude and fuel oils. Nine oils commonly transported on the world's major waterways were tested. Burns were first conducted under warm weather conditions (approximately 30°C) and later under cold weather conditions (approximately 0°C to 10°C). DOE

N83-21085# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.

PARTIAL LIQUEFACTION OF COAL BY FLASH HYDROLYSIS, PHASE 4 Final Technical Report

L. P. COMBS 12 Nov. 1982 306 p refs

(Contract DE-AC22-80PC-30018)

(DE83-002167; DOE/PC-30018/6; ESG-DOE-13390) Avail: NTIS HC A14/MF A01

A 1-ton/h coal hydrolquefaction process development unit (PDU) was studied. Following facility modifications to improve material recoveries, 30 PDU tests were conducted addressing specific objectives. Two supporting experimental studies were conducted. Small specimens of several metal alloys were exposed to the PDU reaction environment and then evaluated. In a cold-flow investigation of dense-phase flow feeding, both pulverized coal and a typical FHP by-product char were fed at elevated pressures. An analytical model for uniform dense-phase plug flow of solids correlated well the experimental coal flow rate as a function of overall feed system pressure drop. Liquid product samples PDU tests were subjected to indepth characterization of their chemical make-up and properties. Through comparison with other studies of coal liquids from other liquefaction processes and with conventional petroleum processing technology, a preliminary engineering study estimated processing requirement for upgrading the PDU liquid products and estimated potential costs of such upgrading. DOE

N83-21086# International Coal Refining Co., Allentown, Pa

SRC-I PROJECT BASELINE

Mar 1982 323 p 2 Vol

(Contract DE-AC05-78OR-03054)

(DE83-000987, DOE/OR-03054/T13-VOL-2) Avail: NTIS HC A14/MF A01

The Process Design Criteria Specifications forms the basis for process design for the 6000-TPSD SRC-I Demonstration Plant. It sets forth: basic engineering data, e.g., type and size of plant, feedstocks, product specifications, and atmospheric emission and waste disposal limits; utility conditions, equipment design criteria and sparing philosophy; and estimating criteria for economic considerations. Previously the formal ICRC Document No 0001-01-002 has been submitted to DOE and revised, as necessary, to be consistent with the SRC-I Project Baseline Revision 6, dated 19 March 1982, 51 pages, was forwarded to DOE on 19 March 1982. DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-21088# Battelle Columbus Labs, Ohio
ADVANCED ATMOSPHERIC FLUIDIZED-BED COMBUSTION DESIGN: ULTRAHIGH VELOCITY Final Report
B C. KIM, R. D. LITT, H. NACK, F. W. SHIRLEY, and R. RAZGAITIS 20 Dec. 1982 126 p refs
(Contract DE-AC21-82MC-19331)
(DE83-004819, DOE/MC-19331/1321) Avail. NTIS HC A07/MF A01

The major findings from an advanced atmospheric fluidized bed combustion design are summarized. It is concluded from these findings that the ultra high velocity (UHV) fluidized bed combustion system meets the criteria established for an advanced AFBC system. It has the potential for achieving significant technological and economical improvements over the existing AFBC systems. The key technical uncertainties needing resolution before this concept can be considered to have reasonable commercial potential are identified as: operability of the UHV system over the extended turndown range; potential equipment erosion problems anticipated during operation of high gas velocity and solids circulation, and the system performance over the prescribed turndown range to meet the desired performance goals. An R and D program plan to address these issues was developed, and it is believed that the trick involved in overcoming these technical barriers is well justified by the high payoff potential of the UHV system. DOE

N83-21089# Oak Ridge National Lab, Tenn Metals and Ceramics Div
SELECTING AND TESTING OXYGEN-MEASURING SYSTEMS FOR FLUIDIZED-BED COMBUSTORS
J I FEDERER Jan 1983 36 p refs
(Contract W-7405-ENG-26)
(DE83-005987, ORNL/TM-8520) Avail. NTIS HC A03/MF A01

The performance characteristics of commercially available oxygen-measuring systems (OMSs) were compared to identify a device for use in fluidized-bed combustors (FBCs). The comparison indicated that only instruments with ceramic electrolytes are capable of making the required measurements. Several sensors were then tested for accuracy and response time in a laboratory apparatus to assess their suitability for FBC use. Because of their physical configuration, two sensors of the type used to measure oxygen in flue gases had responses substantially slower than that required. Sensors of the type used in automobile exhaust systems had significantly faster responses. For the latter sensors the results demonstrated that response time is a function of initial and final oxygen concentrations. The automotive sensor was much less catalytic to reactive gases than were the other sensors. This behavior suggests that the response of ceramic electrolyte sensors in reactive gases can vary from the actual oxygen content to the thermodynamic equilibrium value, the actual response depending on sensor characteristics that affect catalysis. DOE

N83-21091# Brigham Young Univ., Provo, Utah Dept of Chemical Engineering
COMBUSTION RESEARCH NEEDS Final Report
L D SMOOT and S C HILL Mar 1982 90 p refs
(Contract NSF-81-SP-1151)
(PB83-107813, NSF/OIR-82002) Avail. NTIS HC A05/MF A01 CSCI 21B

A six month study to survey the state of the art in combustion research is summarized. Included is a review of the literature and discussions on coal gasification, explorations, fires, liquid and solid fossil fuels, reciprocating and turbine engines, and solid propellants. Fundamental combustion areas are examined, including the chemistry of combustible materials, combustor modeling, diagnostics and instrumentation, droplet and gas phase kinetics, and fluid mechanics. Results are presented of a survey of professionals who recommended research needs in the areas of turbulence/fluid mechanics, diagnostics/instrumentation, and combustor modeling. Evaluations of this document by two combustion researchers are included. GRA

N83-21127# California Univ., Berkeley. Dept of Material Sciences and Mineral Engineering.
LOW-ALLOY STEELS FOR THICK-WALLED PRESSURE VESSELS Final Report, 1 Oct. 1978 - 31 Mar. 1980
J. A. TODD, V. F. ZACKAY, and E. R. PARKER 1980 85 p refs
(Contract DE-AT03-76ET-10699)
(DE83-002547, DOE/ET-10699/T1) Avail. NTIS HC A05/MF A01

This program aims to modify existing commercially available pressure vessel steels and to develop new steels which can be field fabricated into thick sectioned pressure vessels for coal gasification and liquefaction systems. During 1978-79, transmission electron microscopy has been carried out on 225Cr-1Mo, samples of which have been cooled at rates simulating those obtained in commercial plates up to 16 in thick. The tempering responses at different temperatures have also been fully characterized. These studies were repeated on the alloy modifications. Programs have been developed to eliminate temper embrittlement in 225Cr-1Mo and also in 3.5Ni-1.5Cr steels and a study of the microstructural aspects of weldability has also been initiated. Fracture mechanics studies have been initiated on A533B and its alloy modifications. Isothermal transformation of Alloy 4 (Fe-0.1%C-0.5V-0.5Mn) and Alloy 5 (Fe-0.1C-0.5V-0.5Mn-3Ni) showed that uniform VC particle dispersions with optimum strength and toughness properties could be achieved in Alloy (i.e., by addition of 3%Ni). DOE

N83-21136# Case Western Reserve Univ., Cleveland, Ohio Dept. of Metallurgy and Materials Science.
LOCALIZED CORROSION IN MATERIALS FOR GEOTHERMAL POWER Final Report
A R TROIANO and R F HEHEMANN Apr 1982 145 p refs
(Contract DE-AC02-76ET-28317)
(DE82-015608, DOE/ET-28317/T2) Avail. NTIS HC A07/MF A01

The influence of 16 different geothermally related environments on a number of potentially useful steels was examined for both general and localized corrosion and at ambient and 150 C. Variation in chloride concentration of 1 to 20% generally demonstrated only minor aggressiveness in acidified solutions. In general, the presence of H₂S raised the corrosion rate. However, very low concentrations (10 ppm) indicated higher rates than in saturated brines. This is rationalized on the basis of the inability to develop a semiprotective film at the low H₂S concentration. The corrosion rate for the Cr-Mo steel was unexpectedly high at ambient, but improved substantially at 150 C. The Ni-Cu-Nb steel consistently demonstrated excellent resistance in all environments, except the 10 ppm H₂S at ambient. At 150 C there were no exceptions to its superior performance. Maximum pit depth studies, analyzed statistically, indicated that the Ni-Cu-Nb alloy was the most resistant to localized attack. DOE

N83-21165# National Mechanical Engineering Research Inst., Pretoria (South Africa)
PROPANOL-PLUS AS EXTENDER TO DIESEL FUEL
I S. MYBURGH 1982 7 p refs
(CSIR-ME-445) Avail. NTIS HC A02/MF A01

A by-product of the SASOL fuel from coal process, propanol plus was found to be the most satisfactory diesel fuel extender of all the alcohols tested. Fuel requirements and properties discussed include (1) initial boiling temperature; (2) heat of combustion, (3) viscosity, (4) flash point temperature; (5) autoignition quality, and (6) miscibility with diesel. The constituents of propanol plus are listed by mass and results of engine tests are examined. A R H

04 FUELS AND OTHER SOURCES OF ENERGY

N83-21166# National Mechanical Engineering Research Inst., Pretoria (South Africa)

A STUDY OF POSSIBLE DETRIMENTAL EFFECTS ON INTERNAL COMBUSTION ENGINES BY THE COMBUSTION OF GASOLINE BLENDS

I S MYBURGH, G KERENS, and E VANBERGEN (Datsun-Nissan Co (Pty) Ltd, Rosslyn, South Africa) May 1982 6 p Presented at the 5th Intern Alcohol Fuel Technol Symp, Auckland, New Zealand, May 1982

(CSIR-ME-446) Avail NTIS HC A02/MF A01

Petrol/alcohol blends are marketed and supplied through the normal retail outlets as a fuel for motor vehicles. The alcohol, produced as a by-product from the SASOL process consists mainly of ethanol with the higher alcohols n-propanol, secondary butanol and iso-propanol. The long term effect of this alcohol on engine life when used in a blend with petrol was investigated. S L

N83-21169# Boeing Military Airplane Development, Seattle, Wash Operational Analysis Group

FUEL/ENGINE/AIRFRAME TRADE-OFF STUDY: OPERATIONAL EFFECTS OF INCREASED FREEZE POINT FUELS Final Report, 2 Mar. 1981 - 30 Apr. 1982

P M MCCONNELL, L A MASSMANN, G N PETERSON, and F P TOLLE Wright-Patterson AFB, Ohio AFWAL Aug 1982 180 p refs

(Contract F33615-78-C-2001, AF PROJ 3048)

(AD-A121688; AFWAL-TR-82-2067) Avail NTIS HC A09/MF A01 CSCL 21D

This study of extreme low temperature C-141, KC-135, and B-52 operational missions indicates that the -58 C freeze point specification for JP-4 fuel is ultra conservative. The study suggests that the freeze point could be increased by at least 12 C with no effect on in-flight performance and that there is a good possibility that commercial, Jet A fuel (-40 C freeze point) would be acceptable for these aircraft. A method of identifying realistic extreme low temperature, in-flight exposure and airplane fuel system response was developed. The ground environmental extremes were not studied and could impact the conclusions. GRA

N83-21171# Du Pont de Nemours (E. I.) and Co., Aiken, S C FLEET EXPERIENCE USING A METHANOL/UNLEADED GASOLINE BLEND

D S. SIMPSON Nov 1982 20 p refs

(Contract DE-AC09-76SR-00001)

(DE83-003834, DP-1648) Avail NTIS HC A02/MF A01

The Savannah River Plant is successfully operating automotive and nonautomotive gasoline powered equipment on a 3% methanol/97% unleaded gasoline blend. A test fleet of 50 vehicles began using the methanol/gasoline blend in March 1982, and following positive results, the remainder of the plant fleet began recording mileage on the blend fuel in June 1982. The plant fleet contains approximately 750 automotive and 250 nonautomotive units; and in six months, approximately 2.2 million miles have been driven using the blend fuel. DOE

N83-21172# Southwest Research Inst., San Antonio, Tex Energy Systems Research Div

REFINING STUDIES AND ENGINE TESTING OF ALTERNATIVE HIGHWAY-TRANSPORTATION FUELS: IDENTIFICATION AND EVALUATION OF OPTIMIZED ALTERNATIVE FUELS Final Report

N R SEFER, J A RUSSELL, T W RYAN, III, and T J CALLAHAN Sep 1982 129 p refs

(Contract DE-AC01-79CS-50017)

(DE83-003332, DOE/CS-50017/3) Avail NTIS HC A07/MF A01

The study of alternative highway transportation fuels was conducted in three major phases. Linear programming models were used in the first phase to show how shale oil and coal liquids would be used. Models for Rocky Mountain, Mid-Continent, and Great Lakes composite refineries were developed to make forecast quantities of products in 1995. Computer cases investigated maximum diesel fuel and broadcut fuel in each region. Use of

methanol, ethanol, and MTBE in gasoline was explored in one region. Results included product quality and compositions. Fuel formulation and blending were conducted in the second phase. Synthetic products from shale and coal were used in a series of diesel and broadcut fuels. A group of synthetic gasolines was also prepared, some of which were simulated coal derived products. Products were shared with other laboratories for evaluation. Engine testing was the final phase of the project. All fuels were subjected to screening tests in single cylinder CLR engines of either spark or compression ignition type. Selected fuels were given durability tests in the same engine and chassis dynamometer tests in vehicles. DOE

N83-21173# Singmaster and Breyer, New York.

TECHNICAL/COMMERCIAL FEASIBILITY STUDY OF THE PRODUCTION OF FUEL-GRADE ETHANOL FOR CORN: 100-MILLION GALLON-PER-YEAR PRODUCTION FACILITY IN MYRTLE GROVE, LOUISIANA

31 May 1982 465 p 6 Vol.

(Contract DE-FG07-81ID-12274)

(DE83-000772, DOE/ID-12274/T1-VOL-6) Avail NTIS HC A20/MF A01

Appendices are included for specifications and design criteria, equipment list, motor list, companies contacted for marketing, and schedules for a feasibility study of an ethanol from corn production facility. DOE

N83-21174# Faucett (Jack) Associates, Inc., Chevy Chase, Md **ENERGY INPUTS AND OUTPUTS OF FUEL-ALCOHOL PRODUCTION, SUMMARY VOLUME Final Report**

Apr 1982 73 p refs

(Contract DE-AC01-80CS-50005)

(DE83-000367, DOE/CS-50005/T1-SUMM) Avail NTIS HC A04/MF A01

A summary and comparison are presented of the energy inputs and outputs for producing 100 million Btu of alcohol from representative versions of the three alternatives studied: ethanol from grain, methanol from cellulose, and methanol from coal. Methanol from cellulose appears to be the most attractive of the alternatives from a net energy standpoint. DOE

N83-21175# Faucett (Jack) Associates, Inc., Chevy Chase, Md **ENERGY INPUTS AND OUTPUTS OF FUEL-ALCOHOL PRODUCTION. APPENDICES A AND B, ETHANOL FROM GRAIN**

Apr 1982 71 p refs

(Contract DE-AC01-80CS-50005)

(DE83-000368, DOE/CS-50005/T1-APP-A-B) Avail NTIS HC A04/MF A01

Estimates are developed of present energy requirements for producing five grains (corn, grain, sorghum, winter wheat, barley and oats) and of energy requirements for increasing production of two of these grains (corn and grain sorghum). Brief discussions are also included of the overall potential for increasing crop land and for increasing grain production for conversion to ethanol. The energy and materials consumption of both wet and dry milling technologies are considered for the conversion of grain to ethanol. DOE

N83-21176# Midwest Research Inst., Golden, Colo Solar Energy Research Inst

REFORMED METHANOL

J G FINEGOLD, J T MCKINNON, and M E KARPUK 1982 14 p refs

(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)

(DE83-002096, SERI/TP-235-1774) Avail NTIS HC A02/MF A01

This paper describes the design and testing of an automotive fuel system that provides hydrogen-rich gases to an internal combustion engine by catalytically cracking, or dissociating, methanol on board the vehicle. The vaporization and dissociation of methanol absorb heat from the engine exhaust and increase the lower heating value of the fuel by approximately 22%. In

04 FUELS AND OTHER SOURCES OF ENERGY

addition, raising the compression ratio and burning with excess air increase the engine thermal efficiency. Engine dynamometer test results with dissociated methanol demonstrated improvements in brake thermal efficiency compared to gasoline of up to 50% depending on engine speed and torque. Lower speeds and torques produce the largest improvements. This paper presents maps of exhaust temperature and exhaust heat content. The exhaust temperature is almost always high enough for dissociation to occur, but, at lower power outputs, there is only enough exhaust energy for partial dissociation of the methanol. This concept also applies to combustion turbines. Steam reformed methanol allows higher efficiency and more power compared to petroleum fuels, liquid methanol, or dissociated methanol. The hydrogen-rich gases do not require cooling before entering the turbine. DOE

N83-21177# Faucett (Jack) Associates, Inc., Chevy Chase, Md
ENERGY INPUTS AND OUTPUTS OF FUEL-ALCOHOL PRODUCTION, APPENDICES G AND H. METHANOL FROM COAL

Apr 1982 66 p refs
(Contract DE-AC01-80CS-50005)
(DE83-000370, DOE/CS-50005/T1-APP-G-H) Avail NTIS HC A04/MF A01

The energy consumed in mining coal for eventual conversion to methanol is analyzed. Energy consumption estimates are developed for both underground and surface mining methods. The estimated energy requirements to convert mined coal to fuel grade methanol are described. DOE

N83-21178# Faucett (Jack) Associates, Inc., Chevy Chase, Md
ENERGY INPUTS AND OUTPUTS OF FUEL-ALCOHOL PRODUCTION, APPENDICES C THROUGH F. METHANOL FROM CELLULOSE

Apr 1982 112 p refs
(Contract DE-AC01-80CS-50005)
(DE83-000369, DOE/CS-50005/T1-APP-C-F) Avail NTIS HC A06/MF A01

Estimates are developed of the amount of fuel that would be consumed in the collection of forest residues, by harvest system type and by logging operation. Separate estimates are developed for both the Eastern and Western regions of the United States. The availability of both forest residues and mill residues are discussed. The energy inputs for the growing, harvesting, and processing of wood feedstocks for conversion into alcohol fuels are identified on the basis of a conceptualized operation of a silvicultural biomass farm. Estimates are developed of energy consumption resulting from the collection and of the overall availability of crop residues. Estimates are developed of the energy inputs and outputs for the production of methanol from cellulosic materials. DOE

N83-21185# Aerospace Corp., El Segundo, Calif
Energy Conservation Directorate
ASSESSMENT OF METHANE-RELATED FUELS FOR AUTOMOTIVE FLEET VEHICLES. VOLUME 1: EXECUTIVE SUMMARY

Feb 1982 51 p 3 Vol.
(Contract DE-AC02-80CS-0179)
(DE83-000280, DOE/CE-50179/1-VOL-1) Avail NTIS HC A04/MF A01

The use of methane-related fuels, derived from a variety of sources, in highway vehicles is assessed. The term methane, includes and is interchangeable with natural gas (NG) as well as synthetic (or substitute) natural gas (SNG), provided methane is the predominant constituent. Methanol is included because it can be produced from NG or the same resources as SNG, and because it is a liquid fuel at normal ambient conditions. Technological, operational, efficiency, petroleum displacement, supply, safety and economic issues are analyzed. The assessment is intended to satisfy Section 7(a) of the Methane Transportation Research, Development, and Demonstration Act of 1980 (PL 96-512), which focuses on expanded methane use in automotive fleet vehicles and farm equipment. DOE

N83-21188# General Accounting Office, Washington, D C
Energy and Minerals Div

STATUS OF THE GREAT PLAINS COAL GASIFICATION PROJECT, AUGUST 1982

14 Sep 1982 39 p refs
(PB83-115139, GAO/EMD-82-117, B-207876) Avail NTIS HC A03/MF A01 CSCL 21D

Construction of the Great Plains coal gasification plant is 4 to 6 weeks behind schedule, but no long term impacts are anticipated. Cumulative project costs are lower than originally estimated. Overall, the management system established to oversee project construction appears comprehensive. However, some weaknesses exist in the computerized information system, which produces most project data. The cost incurred by Great Plains are audited to determine that funds are being used only for eligible projects. GRA

N83-21328# Pacific Northwest Lab., Richland, Wash
REAL TIME SENSORS IN GEOTHERMAL FLUIDS, THEIR COSTS AND BENEFITS

G. A. JENSEN, D. W. SHANNON, and R. F. HAZELTON Feb 1982 22 p refs Presented at the Can. Western Region Meeting of the Natl. Assoc. of Corrosion Engr., Victoria, British Columbia, 23-27 Feb 1982
(Contract DE-AC06-76RL-01830)
(DE82-014857, PNL-SA-10229; CONF-820248-1) Avail NTIS HC A02/MF A01

Geothermal power plants, and several cases where problems were identified and in some cases prevented are discussed. Cost factors, savings, and benefits costs to the sponsor are summarized and the benefits of installation of real time instrumentation in the power plant are characterized. DOE

N83-21494# Argonne National Lab., Ill
Land Reclamation Program

ALASKAN COAL: RESOURCES AND DEVELOPMENTAL CONSTRAINTS

D. E. EDGAR, L. J. ONESTI (Indiana Univ.), and G. M. KASZYNSKI (ESCOR, Inc.) Mar 1982 139 p refs
(Contract W-31-109-ENG-38)
(DE83-000860, ANL/LRP-18) Avail: NTIS HC A07/MF A01

Exploration of coal deposits in Alaska which may be as much coal as found in all of the 48 conterminous states is discussed. Most of the coal deposits are located in the North Slope Basin and associated strata extending beneath the Chukchi Sea, the Nenana Basin of the interior, and the Cook Inlet Basin in the south. Most Alaskan coal is subbituminous to bituminous with relatively high moisture and ash content, moderate heat value, and very low sulfur content, may deposits are well suited for surface mining. It is anticipated that mining will increase dramatically in the next few years in response to a developing Far East market. Near term increases in production will probably come from the existing mine and from new mines in the interior and south central regions of the state. There is limited experience in Alaskan surface coal mining and reclamation and it is recommended that research be conducted to develop cost effective mining and reclamation technologies that minimize or prevent adverse impacts on Alaska's unique ecosystems. DOE

N83-21496# Los Alamos Scientific Lab., N. Mex
GEOTHERMAL DATA FOR 95 THERMAL AND NONTHERMAL WATERS OF THE VALLES CALDERA, SOUTHERN JEMEZ MOUNTAINS REGION, NEW MEXICO

F. GOFF, T. P. E. MCCORMICK, JR., D. COUNCE, and C. O. GRIGSBY May 1982 55 p refs
(Contract W-7405-ENG-36)
(DE82-017397, LA-9367-OBES) Avail NTIS HC A04/MF A01

Field, chemical, and isotopic data for 95 thermal and nonthermal waters of the southern Jemez Mountains, New Mexico are presented. This region includes all thermal and mineral waters associated with Valles Caldera and many of those located near the Nacimiento Uplift, near San Ysidro. Waters of the region can be categorized into five general types: surface and near surface

meteoric waters, acid sulfate waters (Valles Caldera), thermal meteoric waters (Valles Caldera), and mineralized waters near San Ysidro. Some waters display chemical and isotopic characteristics intermediate between the types listed. The object of the data is to help interpret geothermal potential of the Jemez Mountains region and to provide background data for investigating problems in hydrology, structural geology, hydrothermal alterations, and hydrothermal solution chemistry DOE

N83-21499# International Inst. for Applied Systems Analysis, Laxenburg (Austria).

A REVIEW OF WORLD HYDROCARBON RESOURCE ASSESSMENTS Final Report

M. GRENON Nov 1982 161 p refs (DE83-900732, EPRI-EA-2658) Avail. NTIS HC A08/MF A01

Past assessments of world oil, natural gas, and oil-shale resources are reviewed. It identifies the methods used in making these assessments (historical statistics, geological analogy, engineering, and probabilistic), the geographical coverage, the time horizons, and the major assumptions about such factors as discovery rates, and recovery factor. The period covered extends from the end of World War II to the end of 1980. Conclusions are presented on the current state of knowledge and understanding concerning each of these three hydrocarbon resources. Regarding world oil resources, an assumed consensus on 2000 billion barrels ultimately recoverable is, in fact, only weakly supported. Close examination of its component parts reveals widespread disagreement. World natural gas resources are even less well understood. And it is premature to venture a meaningful assessment of world oil-shale resources. Thus, our knowledge and scientific understanding of these significant hydrocarbon resources is inadequate for long-term energy planning DOE

N83-21502# British Library Lending Div., Boston Spa (England). **UTILIZATION OF SECONDARY ENERGY RESOURCES AT MAGNITOGORSK METALLURGICAL COMBINE**

V. N. ERMOLAEV and V. I. KLYUVGANT 20 Dec 1982 14 p Transl into ENGLISH from Stal (USSR), v 12, 1981 p 8-11 (BLL-M-26856-(5828 4)) Avail. British Library Lending Div., Boston Spa, Engl

Savings obtained by the use of secondary thermal and energy resources at Magnitogorsk Metallurgical Combine during the period of the 10th five year plan are reviewed. These savings were obtained by fuller utilization of these resources, e.g., fuel from the use of blast furnace and coke oven gases and steam from boiler utilizers and evaporative cooling systems. The savings achieved were substantial. Author

N83-21505# Linde AG, Hohlriegelskreuth (West Germany). **Tieftemperatur- und Verfahrenstechnik**

OXYGEN SUPPLY FOR COAL GASIFICATION POWER STATIONS (COMBINED CYCLE PROCESS) Final Report, Feb. 1981

D. ROTTMANN and E. SCHOENPFLUG Bonn Bundesministerium fuer Forschung und Technologie Feb 1982 75 p In GERMAN, ENGLISH summary (BMFT-FB-T-82-018, ISSN-0340-7608) Avail. NTIS HC A04/MF A01

Adaptation of air separation processes to coal gasification plants was investigated. Main points are the start up and the load change behavior of the total process. Air separation processes which put at disposal oxygen most energetically to the combined cycle process are estimated. The technical feasibility of such a plant is checked. The load change behavior of the plant, the adaptation of the coal gasification and the start up of the total system are investigated. The influence of process parameters on the energy consumption is calculated. The most economical air separation processes are investigated. It is found that a low pressure plant with mixed heat exchangers and a medium pressure plant with molsieves are the most economical processes and that air separation processes and the order of magnitude can be constructed economically E A K

N83-21506# Kraftwerk Union A.G. Reaktortechnik, Erlangen (West Germany). **Hauptbereich Vernetzung und Kraftwerktechnik POWER PLANT CONCEPTS USING NEW COAL CONVERSION TECHNOLOGIES Final Report, Dec. 1980**

W. EMSPERGER, R. ENGELHARDT, K. GOEBEL, U. SCHIFFERS, H. TRAENKENSCHUH, and E. WITTCROW Bonn Bundesministerium fuer Forschung und Technologie Mar. 1982 238 p refs In GERMAN; ENGLISH summary (BMFT-FB-T-82-031, ISSN-0340-7608, BMFT-03E1124, A/ETS6004A) Avail. NTIS HC A11/MF A01

Alternatives to pulverized coal firing are presented for the use even of low grade coals in large power plant units. The unit ratings and potential efficiencies of such plants are defined and the main determining parameters are analyzed. The problems of start up and part load operation are also discussed. The selection of gasification methods for power plant processes as a basis for power plant concepts using coal gasification is considered. The state of development of the gasification and gas scrubbing processes is described. Conceptual plant configurations and unit ratings are presented. It is demonstrated that there is an incentive to construct power plant processes that incorporate fluidized bed combustion or coal gasification but that a number of development problems remain to be solved for commercial application to become viable E A K

N83-21507# Siemens AG, Erlangen (West Germany). **Forschungslab**

CONTINUOUSLY ADJUSTABLE LOW-POWER GASIFIER BURNER/BOILER SYSTEM Final Report, Mar. 1981

H. KOSTKA and A. MICHEL Bonn Bundesministerium fuer Forschung und Technologie Apr 1982 134 p refs In GERMAN, ENGLISH summary (BMFT-FB-T-82-038; ISSN-0340-7608) Avail. NTIS HC A07/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 28,15

The catalytic gasification of straight run gasoline by partial oxidation with air was studied. Test models of a gasifier/boiler system which utilizes heating oil as primary fuel were developed. The systems have the following characteristics: (1) power range from 2 kW to 12 kW, (2) continuously adjustable power, (3) stoichiometric combustion, (4) soot free operation, (5) load independent exhaust temperature, and (6) low, constant exhaust temperature E A K

N83-21519# Oak Ridge National Lab., Tenn. Fossil Energy Materials Program Office.

FOSSIL ENERGY MATERIALS PROGRAM PLAN FOR FISCAL YEARS 1982 THROUGH 1986

R. A. BRADLEY, comp and R. R. JUDKINS, comp Dec 1982 146 p refs (Contract W-7405-ENG-26)

(DE83-004237, ORNL/TM-7964) Avail. NTIS HC A07/MF A01

A program plan for the Department of Energy Advanced Research and Technology Development Fossil Energy Materials Program reviews the background, technical issues, and research and development needs for materials of construction for fossil energy systems. The status and plans for research and development activities in the Advanced Research and Technology Development (AR and TD) Fossil Energy Materials Program are then discussed for various materials disciplines. Detailed information about these plans is provided for FY 1982 through FY 1984, and descriptions of long-range plans are given for FY 1985 and FY 1986. In addition to descriptions of planned research activities, this plan provides levels of effort required for the various activities. Thus, the emphasis of the program on long-range basic research to address perceived materials problems in the development of fossil energy technologies is indicated DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-21523# Utah Univ, Salt Lake City.

GEOTHERMAL POTENTIAL OF ASCENSION ISLAND, SOUTH ATLANTIC. PHASE 1: PRELIMINARY EXAMINATION

B. S. SIBBETT, D. L. NEILSON, J. H. RAMSTHALER (Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho), and M. K. SHANE (Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho) 5 Apr 1983 94 p refs

(Contract DE-AC07-76ID-01570)

(DE83-004066, IDO-10110) Avail NTIS HC A05/MF A01

A preliminary evaluation of the potential for an economic geothermal resource at Ascension Island was completed. It is concluded that there is a high potential for the presence of a geothermal resource under the Island. A conceptual plant was designed assuming the resource potential located near Gannet Hill is developed. A 7% discounted payback of 5.9 years was calculated for the baseline geothermal plant. Geothermal development can be easily integrated into the Ascension Island power system in that a selection of small, portable, skid mounted, turn key power geothermal generating systems are commercially available. Geologic findings and plant analysis are summarized.

DOE

N83-21524# Argonne National Lab, Ill. Special Projects and Industrial Applications Group

ENERGY FROM BIOMASS: LAND ANALYSIS AND EVALUATION OF SUPPLY MODELS

S. Y. SHEN, J. STAVROU, C. H. NELSON, and A. VYAS Jan. 1982 37 p refs

(Contract W-31-109-ENG-38)

(DE83-003333, ANL/CNSV-32) Avail NTIS HC A03/MF A01

Methods of determining the potential overall impact of land-based biomass production on the agricultural and forestry sectors of the US economy were evaluated. The availability of the factor that possibly limits biomass production the most, land is examined. A summary by US Department of Agriculture regions of the amount of available land with potential for biomass production and not presently in food crop production is presented. Then several currently used agricultural and forestry models that could be used to determine the impact of increased land-based biomass production on the agricultural and forestry sectors are evaluated. It was found that the forestry sector would not be significantly effected even by a level of biomass production with an energy yield as high as 11 quads. It was recommended that a suitable linear programming model from Iowa State University's Center for Agricultural and Rural Development (CARD) modeling system be used for future analysis. The CARD model would have to be appropriately modified so that biomass grasses and short-rotation trees could be added to the agricultural crops.

DOE

N83-21529# United Technologies Research Center, East Hartford, Conn

CERAMIC HEAT-EXCHANGER APPLICATIONS STUDY

D. J. MCFARLIN, C. T. SGAMBOTI, and R. D. LESSARD Oct. 1982 99 p refs

(Contract W-7405-ENG-26)

(DE83-003166, ORNL/SUB-81/92352/1) Avail NTIS HC A05/MF A01

To put the potential benefits of ceramic heat exchangers (CHX) applications into quantitative perspective, several industrial cogeneration and electric utility power generation systems were evaluated. Coal based fuel fired applications, for which system performance and economic assessments were made were studied. Seven CHX applications were selected for evaluation. These include (1) gasified coal fired gas turbine, (2) pressurized fluidized bed combustor (PFBC) gas turbine, (3) atmospheric fluidized bed combustor (AFBC) gas turbine; (4) and (5) AFBC combined cycle with and without reheat, and (6) and (7) indirect coal fired gas turbine and combined cycle. The performance and economics of these cogeneration systems were evaluated and compared with other competing systems. For the electric utility power generation sector five applications utilizing a CHX were selected and evaluated, their performance and cost factors were compared to those of a reference pulverized coal fired steam plant with flue gas

desulfurization. The five applications included PFBC combined cycle, AFBC combined cycle, industrial coal gasifier combined cycle, indirect coal fired combined cycle, and indirect coal fired simple cycle. Of the five CHX applications evaluated in the power generation sector, only the AFBC system shows a clear gain over the reference pulverized coal system.

DOE

N83-21531# Singmaster and Breyer, New York

TECHNICAL/COMMERCIAL FEASIBILITY STUDY OF THE PRODUCTION OF FUEL-GRADE ETHANOL FROM CORN: 100-MILLION-GALLON-PER-YEAR PRODUCTION FACILITY IN MYRTLE GROVE, LOUISIANA. VOLUME 1: EXECUTIVE SUMMARY

31 May 1982 153 p 7 Vol

(Contract DE-FG07-81ID-12274)

(DE83-000777; DOE/ID-12274/T1-VOL-1) Avail NTIS HC A08/MF A01

An executive summary is given of a detailed feasibility study for a 100 million gallon per year power alcohol plant using corn as feedstock. The proposed plant will ultimately have the capability to produce 100 million gallons per year of anhydrous alcohol from an estimated 40 million bushels of corn and will be designed so as to allow construction in modules of 25 million gallons each. Alcohol produced at this plant is intended essentially for use as a gasoline octane booster, a motor fuel in gasoline/alcohol blends and as a chemical feedstock. In addition, the plant will produce a number of by-products, each of which has existing commercial markets; namely, 236,400 tons of CO₂, 237,600 tons of protein meal mixture (40.2% protein), or 124,000 tons of gluten meal (41% protein), 20,000 tons of yeast, 68,400 tons of corn bran, 89,600 tons of corn germ cake and 4,584,000 gallons of corn oil (food grade).

DOE

N83-21532# Singmaster and Breyer, New York

TECHNICAL/COMMERCIAL FEASIBILITY STUDY OF THE PRODUCTION OF FUEL-GRADE ETHANOL FROM CORN: 100-MILLION-GALLON-PER-YEAR PRODUCTION FACILITY IN MYRTLE GROVE, LOUISIANA

31 May 1982 343 p 7 Vol.

(Contract DE-FG07-81ID-12274)

(DE83-000776, DOE/ID-12274/T1-VOL-2) Avail NTIS HC A15/MF A01

The technical and economic feasibility of producing motor fuel alcohol from corn in a 100 million gallon per year plant to be constructed in Myrtle Grove, Louisiana is evaluated. The evaluation includes a detailed process design using proven technology, a capital cost estimate for the plant, a detailed analysis of the annual operating cost, a market study, a socioeconomic, environmental, health and safety analysis, and a complete financial analysis. Several other considerations for production of ethanol were evaluated including cogeneration and fuel to be used in firing the boilers, single by-products vs multiple by-products; and use of boiler flue gas for by-product drying.

DOE

N83-21533# Singmaster and Breyer, New York

TECHNICAL/COMMERCIAL FEASIBILITY STUDY OF THE PRODUCTION OF FUEL-GRADE ETHANOL FROM CORN: 100-MILLION-GALLON-PER-YEAR PRODUCTION FACILITY IN MYRTLE GROVE, LOUISIANA

31 May 1982 513 p 7 Vol.

(Contract DE-FG07-81ID-12274)

(DE83-000775, DOE/ID-12274/T1-VOL-3) Avail NTIS HC A22/MF A01

The technical and engineering plan for an ethanol from corn fuel grade production facility is given. Included is a review of current technology, process technology recommendation, single vs multi by-product process, process description, resource requirements, utilities, use of boiler flue gas for by-product drying, plant layout alternatives, production schedule, and procurement plan. As components of production the following are covered: corn supply, other raw materials supply, site selection, and the socioeconomic environment of the area. The community infrastructure of Plaquemines Parish is described.

DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-21534# Singmaster and Breyer, New York.
TECHNICAL/COMMERCIAL FEASIBILITY STUDY OF THE PRODUCTION OF FUEL-GRADE ETHANOL FROM CORN: 100-MILLION-GALLON-PER-YEAR PRODUCTION FACILITY IN MYRTLE GROVE, LOUISIANA. VOLUME 5: APPENDICES

31 May 1982 556 p 7 Vol
 (Contract DE-FG07-81ID-12274)
 (DE83-000773, DOE/ID-12274/T1-VOL-5) Avail NTIS HC A24/MF A01

Issues pertinent to a feasibility analysis of a corn to fuel-grade ethanol production facility are discussed. Included are: comparison of assumptions and results among studies, base case scenarios, production option analyses, selected sensitivity analysis reference output data, background on government incentives, industrial revenue bonds in Louisiana (conditions and procedures, draft permit application), and capital cost estimates DOE

N83-21535# Singmaster and Breyer, New York.
TECHNICAL/COMMERCIAL FEASIBILITY STUDY OF THE PRODUCTION OF FUEL-GRADE ETHANOL FROM CORN: 100-MILLION-GALLON-PER-YEAR PRODUCTION FACILITY IN MYRTLE GROVE, LOUISIANA

31 May 1982 163 p refs 7 Vol
 (Contract DE-FG07-81ID-12274)
 (DE83-000774, DOE/ID-12274/T1-VOL-4) Avail NTIS HC A08/MF A01

The management and execution plan for phase 2 construction of an ethyl alcohol production facility is given. Socioeconomic, environmental, health and safety issues are discussed. An economic analysis and a feasibility analysis are given DOE

N83-21581# Institute for Energy Analysis, Oak Ridge, Tenn.
ELECTRIC HOME HEATING: SUBSTITUTION FOR OIL AND GAS

C C. BURWELL, W D DEVINE, JR, and D L PHUNG Mar 1982 201 p refs
 (Contract DE-AC05-76OR-00033)
 (DE82-013762; ORAU/IEA-82-3(M)) Avail NTIS HC A10/MF A01

The objective of the research is to determine the potential for substituting electricity generated with surplus coal and nuclear capacity for gas and oil used for home heating. The relative effectiveness of electric heating was determined by an analysis of the purposes of extra winter sales of electricity to the residential sector compared to a similar analysis for extra winter sales of natural gas. The price of electricity for heating is determined based on utility rate structures for selected utilities (primarily located in the north and south central portions of the country) having surplus coal and nuclear capacity throughout the decade of the 1980s. It is found that, on the average, the overall efficiency of fuel use for heating homes electrically is comparable to the use of combustion systems in the home and that electric heating is substantially less costly than direct heating with oil in regions where coal and uranium are the primary fuels used for power generation DOE

N83-21586# Woodard-Clyde Consultants, San Francisco, Calif.
MONITORING WELL SYSTEMS IN GEOTHERMAL AREAS

B E LOFGREN, J OROURKE, R STERRETT, J THACKSTON, and D FAIN 28 Jan 1981 65 p refs
 (Contract DE-AC07-76ID-01570)
 (DE82-012770, EGG-2185) Avail NTIS HC A04/MF A01

The ability to monitor the injection of spent geothermal fluids at reasonable cost might be greatly improved by use of multiple-completion techniques. Several such techniques, identified through contact with a broad range of experts from the groundwater and petroleum industries, are evaluated relative to application in the typical geologic and hydrologic conditions of the Basin and Range Province of the Western United States. Three basic monitor well designs are suggested for collection of pressure and temperature data. Single standpipe, multiple standpipe, and closed-system piezometers. The single standpipe piezometer is recommended for use at depths less than 152 m (500 ft), several can be clustered in one area to provide information on vertical

flow conditions. At depths greater than 152 m (500 ft), the multiple-completion standpipe and closed-system piezometers are likely to be more cost effective DOE

N83-21587# California Univ., Berkeley. Lawrence Berkeley Lab Earth Sciences Div
MATHEMATICAL MODELING OF THE BEHAVIOR OF GEOTHERMAL SYSTEMS UNDER EXPLOITATION Ph.D. Thesis

G S. BODVARSSON Jan. 1982 377 p refs
 (Contract W-7405-ENG-48)
 (DE82-010925, LBL-13937) Avail NTIS HC A17/MF A01

Analytical and numerical methods were used to model the behavior of geothermal systems under exploitation. A new single-phase three-dimensional simulator, capable of solving heat and mass flow problems in a saturated, heterogeneous porous or fractured medium was developed. The simulator uses the integrated finite difference method for formulating the governing equations and an efficient sparse solver for the solution of the linearized equations. In the theoretical studies, various reservoir engineering problems were examined. These include well-test analysis, exploitation strategies, injection into fractured rocks, and fault-charged geothermal reservoirs DOE

N83-21588# Technicon Analytic Research, Inc., Philadelphia, Pa.

NATIONAL FORECAST FOR GEOTHERMAL RESOURCE EXPLORATION AND DEVELOPMENT WITH TECHNIQUES FOR POLICY ANALYSIS AND RESOURCE ASSESSMENT

T. A. V CASSEL, G. T. SHIMAMOTO, C. B. AMUNDSEN, P. D. BLAIR, W. F. FINAN, M. R. SMITH, and R. H. EDELSTEIN 31 Mar. 1982 168 p refs
 (Contract DE-AC02-79ET-27242)
 (DE82-014641; DOE/ET-27242/T2) Avail NTIS HC A08/MF A01

The background, structure and use of modern forecasting methods for estimating the development of geothermal energy are documented. The forecasting instrument may be divided into two sequential submodels. The first predicts the timing and quality of geothermal resource discoveries from an underlying resource base. The second submodel forecasts the rate and extent of utilization of geothermal resource discoveries. It is based on the joint investment behavior of resource developers and potential users as statistically determined from extensive industry interviews. It is concluded that geothermal resource development, especially for electric power development, will play an increasingly significant role in meeting energy demands. DOE

N83-21589# Associated Industrial Design, Martinez, Calif.
GEOTHERMAL FEASIBILITY STUDY FOR CITY OF SONOMA, CALIFORNIA FOUR MUNICIPAL BUILDINGS

1982 42 p
 (Contract DE-FG06-79ET-27256)
 (DE82-015115, DOE/ET-27256/T14) Avail NTIS HC A03/MF A01

Four buildings in the City of Sonoma, totaling approximately 31,150 square feet, were evaluated to determine the economic feasibility of converting the existing environmental control systems to water source heat pumps utilizing a natural geothermal heat sink. Presently, on the State Park's site, there exists a warm water well which produces 250 gallons per minute of water at 73 F. Based on utility rates forecast by Pacific Gas and Electric, installation of heat pumps in the City buildings at Sonoma does not appear to be attractive. The economic evaluation was continued until the year 2000. Pacific Gas and Electric is re-evaluating its rate forecasts and will issue a new forecast in April 1982. The high capital cost is due to retrofitting the heating, ventilating, and air conditioning equipment for the existing buildings. For a new installation, the concept of using heat pumps should be re-evaluated. DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-21590# Oregon Inst of Tech, Klamath Falls. Geo-Heat Center.

GEOTHERMAL HEATING FACILITIES FOR FRONTIER INN, SUSANVILLE, CALIFORNIA

Mar. 1982 23 p

(Contract DE-FG06-79ET-27256)

(DE82-015114, DOE/ET-27256/T13) Avail NTIS HC A02/MF A01

A 38 unit motel composed of six major sections (coffee shop, A frame units, apartments, back units, two story units and office) was built over a number of years and exhibits widely varying types of construction. Space heating is provided by primarily electric resistance equipment with some propane use. Domestic hot water is provided primarily by propane with some electric resistance. The coffee shop uses fuel oil for both space and domestic hot water heating. A geothermal district heating system is being installed. Although the motel site is not located in the area of construction activity, it is expected that the pipeline will be extended. The potential of retrofitting the existing heating facilities at the inn to geothermal is studied. DOE

N83-21592# Oregon Inst of Tech, Klamath Falls. Geo-Heat Center.

GEOTHERMAL GREENHOUSE HEATING FACILITIES FOR THE KLAMATH COUNTY NURSING HOME, KLAMATH FALLS, OREGON

Feb 1982 20 p refs

(Contract DE-FG06-79ET-27256)

(DE82-015104, DOE/ET-27256/T31) Avail NTIS HC A02/MF A01

The Klamath County Nursing Home, located in Klamath Falls, Oregon, was constructed in 1976. The building of 55,654 square feet currently houses care facilities for approximately 120 persons. During the initial planning for the nursing home, the present site was selected primarily on the basis of its geothermal resource. This resource currently provides space and domestic hot water heating for the nursing home, Merle West Medical Center and the Oregon Institute of Technology. The feasibility of installing a geothermal heating system in a planned greenhouse for the nursing home is explored. The greenhouse system would be tied directly to the existing hot water heating system for the nursing home. DOE

N83-21594# Oregon Inst of Tech, Klamath Falls. Geo-Heat Center.

UTILIZATION OF WARM WELL WATER, EASTERN WASHINGTON STATE

Mar. 1982 19 p

(Contract DE-FG06-79ET-27256)

(DE82-015101, DOE/ET-27256/T25) Avail: NTIS HC A02/MF A01

Utilizing the warm well water for a geothermal greenhouse heating system is highly economically feasible. This is based on using the 88 F water from Anderson Well No. 1 to heat greenhouses totaling approximately 10.6 acres. The additional investment of \$640,000 above the cost for a conventional electric boiler system shows a rate of return of 48.3% on a 20 year life cycle analysis. The simple payback is 3 years. The 88 F well water is not warm enough for prawn (*Macrobrachium rosenbergii*) aquaculture, since water flow requirements are excessive to maintain the desired 80 F pond temperature. However, the water is warm enough to maintain a 60 F pond temperature for trout farming. Trout farming using the 88 F well water directly is probably not economically feasible due to high electrical pumping cost (\$4,626 per year) for the seven 1/2 acre ponds that could be heated. Trout farming using the 75 F effluent water from the 10.6 acre greenhouse to heat four 1/2 acre ponds may be economically feasible since the water booster pumping cost is low (\$1189 per year). DOE

N83-21595# Oregon Inst of Tech, Klamath Falls

GEOTHERMAL-HEATING FACILITIES FOR CARSON ELEMENTARY SCHOOL AND WIND RIVER MIDDLE SCHOOL

Feb. 1982 29 p

(Contract DE-FG06-79ET-27256)

(DE82-015121, DOE/ET-27256/T23) Avail NTIS HC A03/MF A01

The structures and geothermal heating systems of two schools are discussed. The feasibility of geothermal heating of schools is examined. DOE

N83-21596# Midwest Research Inst, Golden, Colo. Solar Energy Research Inst.

ELECTRIC-UTILITY VALUE DETERMINATION FOR WIND ENERGY. VOLUME 2: A USER'S GUIDE

D PERCIVAL and J. HARPER. Jan 1982 121 p

(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)

(DE82-010926, SERI/TR-732-604R-VOL-2) Avail NTIS HC A06/MF A01

A method is described for determining the value of wind energy systems to electric utilities. It is performed by a package of computer models available that can be used with most utility planning models. The final output of these models gives a financial value (dollars per kW) of the wind energy system under consideration in the specific utility system. DOE

N83-21598# Virginia Univ., Charlottesville

COASTAL ZONE WIND ENERGY. PART 3: A PROCEDURE TO DETERMINE THE WIND POWER POTENTIAL OF THE COASTAL ZONE

M GARSTANG, R. PIELKE, and J W SNOW. Mar 1982 49 p refs

(Contract DE-AC06-76RL-01830)

(DE82-014334, PNL-3903-PT-3) Avail NTIS HC A03/MF A01

A stepwise procedure is presented for determining the seasonal and/or annual mean potential wind power density for any location on the East and Gulf coasts of the United States. The steps include reference to the dominant wind regimes and mean power densities already obtained to estimate the wind power potential of the location under consideration; methods to calculate the potential wind power distributions and steps to be taken to locate the best site in the area of interest. The method can be best applied where the atmospheric systems which produce most of the wind energy at the surface are relatively persistent. The method is least successful in areas where the wind field is highly variable. Applications of the complete method requires the use of an existing two or three dimensional mesoscale numerical model. DOE

N83-21609# Southern Methodist Univ., Dallas, Tex. Dept of Geological Sciences

HEAT FLOW AND GEOTHERMAL POTENTIAL OF KANSAS

D D BLACKWELL and J L STEELE. 1981 81 p refs

(Contract DE-AS07-79ET-27204)

(DE83-003235, DOE/ET-27204/T1-VOL-1-SECT-2) Avail NTIS HC A05/MF A01

Four deep hydrologic tests in Kansas were used for a geothermal study. These wells were drilled through the Arbuckle Group to within a few feet of basement and two of the holes were deepened on into the basement and core samples collected of the basement rock. Because of the depth of the four holes and because of the fact that they were cased through most of their depth and left undisturbed to reach temperature equilibrium, it is possible to get highly accurate, stable temperature measurements through the complete sedimentary section. In addition an extensive suite of geophysical logs were obtained for each of the holes (gamma-ray, travel time, density, neutron porosity, electric, etc.) and cuttings were collected at frequent intervals. In addition 5 other holes were logged for supplementary information on the temperature regime in other parts of Kansas. DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-21621# Holmes and Narver, Inc., Las Vegas, Nev. Energy Support Div.

COLADO GEOTHERMAL RESOURCE ASSESSMENT: SHALLOW-HOLE TEMPERATURE SURVEY: INTERMEDIATE-DEPTH HOLES IGH NO. 1 AND NO. 2; DEPTH TEST HOLE 44X-10 Final Report

N O JONES Sep. 1982 70 p

(Contract DE-AC08-76NV-00020; DE-AC08-79ET-27008)

(DE83-002898, HN-00020-1098) Avail NTIS HC A04/MF A01

The Getty Oil Company began the field work on a government cost-sharing venture to assess the geothermal potential in the Colado area of Pershing County, Nevada. Eighteen shallow (500-foot) temperature gradient holes, two intermediate (1500-foot) temperature gradient holes and one deep (8000-foot) exploratory well were drilled. All field work was completed in May 1981. Maximum temperature achieved was 2820 F at 7064 feet. No fluid reservoir was encountered with this hole. DOE

N83-21628# Utah Univ., Salt Lake City Earth Science Lab
GEOTHERMAL DIRECT HEAT PROGRAM ROUNDUP, VOLUME 1

C A RUSCETTA, ed Jul 1982 317 p refs Proceedings of the Geothermal Energy Exploration and Resource Assessment Tech Conf., Salt Lake City, 5-7 Apr 1982

(Contract DE-AS07-28365)

(DE82-019912, DOE/ID-12079/71-VOL-1, ESL-98-VOL-1;

CONF-820491-VOL-1) Avail NTIS HC A14/MF A01

Geothermal resources and utilization in several states are discussed. Studies of heat transmission, volcano-tectonic patterns, exploration and drilling, and geochemistry are given. DOE

N83-21631# Pacific Northwest Lab., Richland, Wash
EVALUATION OF AMMONIA AS A WORKING FLUID FOR A WET/DRY-COOLED BINARY GEOTHERMAL PLANT

M K DROST and H D HUBER Oct 1982 36 p refs

(Contract DE-AC06-76RL-01830)

(DE83-002895, PNL-4068) Avail NTIS HC A03/MF A01

The concepts considered involve various arrangements of the binary geothermal power cycle with advanced dry cooling schemes. Brief descriptions of the binary cycle and advanced cooling schemes are included. Also included are descriptions of the base case concept and the ammonia working fluid concept. Performance and cost estimates were developed for a wet-cooled isobutane cycle plant, wet/dry-cooled isobutane cycle plant, wet-cooled ammonia cycle plant, and a wet/dry-cooled ammonia cycle plant. The performance and cost estimates were calculated using the GEOCOST computer code. The characteristics of the wet/dry cooling system were determined using the BNWGeo computer code. Results of the cooling system analysis are presented, followed by results of the geothermal plant analysis. Conclusions and comments also are included. DOE

N83-21632# Vetter Research, Costa Mesa, Calif
REINJECTION AND INJECTION OF FLUIDS IN GEOTHERMAL OPERATIONS (STATE OF THE ART)

O J VETTER and V KANDARPA 5 Nov. 1982 101 p refs

(Contract DE-AC03-78ET-27146)

(DE83-001857, DOE/ET-27146/T17, VR-82-05-11) Avail NTIS HC A06/MF A01

A summary of the problems associated with reinjection of heat-depleted brines and injection of other fluids such as imported brines and gases is presented. Covered are only injection and reinjection problems which are related to the exploitation of liquid-dominated resources by flash-cycle power plants. Suggestions which may offer solutions to many of the identified problems are also covered. In addition, some ideas that should or could be implemented in planning of implementing and/or executing any new geothermal injection operation are described. DOE

N83-21636# Los Alamos Scientific Lab., N. Mex

USE OF HOT-DRY-ROCK GEOTHERMAL RESOURCES FOR SPACE HEATING: A CASE STUDY

R. G. CUMMINGS, C. J. ARUNDALE, R. L. BIVINS, H. S. BURNES, R. H. DRAKE, and R. D. NORTON Sep. 1982 89 p refs

(Contract W-7405-ENG-36)

(DE83-002947; LA-9541-MS) Avail NTIS HC A05/MF A01

A hot dry rock (HDR) geothermal space heat system proposed for the National Aeronautics and Space Administration's Wallops Flight Center (WFC) will cost \$10.9 million, saving \$4.1 million over the existing oil heating system over a 30-yr lifetime. The minimal, economically feasible plan for HDR at WFC is shown to be the design of a single-fracture reservoir using a combined HDR preheat and a final oil burner after the first 4 years of operation. The WFC cost savings generalize and range from \$3.1 million to \$7.2 million for other HDR sites having geothermal temperature gradients ranging from 250C/km to 400C/km and depths to basement rock of 2400 ft or 5700 ft compared to the 300C/km and 9000 ft to basement rock at WFC. DOE

N83-21641# Arizona Univ., Tucson Dept. of Chemical Engineering

IRRIGATION PUMPING USING GEOTHERMAL ENERGY

D. H. WHITE and L. A. GOLDSTONE Aug 1982 62 p refs

(Contract DE-FC03-80RA-50076)

(DE83-005308, DOE/RA-50076/10) Avail NTIS HC A04/MF A01

The potential of using geothermal energy in an isobutane binary system to drive directly a cluster of irrigation pumps was evaluated. This three well geothermal system, based at 1500 C (3020 F) resource at 2000 m (6560 ft), would cost an estimated \$7,800,000 in capital investment to provide 6000 gpm of irrigation water from 12 water wells. It would serve approximately 4.5 square miles of irrigated agricultural land, with the delivered water costing \$106.76 per acre-foot. This compares with an estimated cost of \$60.78 per acre-foot for a conventional irrigation system driven by natural gas at the current price (1980 dollars) of \$2.72/mm Btu. It is obvious that if natural gas prices continue to rise, or if geothermal resources can be found at depths less than 2000 meters, then the geothermal irrigation pumping system would be attractive economically. The importance of water to the economy and growth of Arizona was summarized. Total water consumption in Arizona is about 7,600,000 acre-feet annually of which about 87% is used for agriculture. DOE

N83-21661# Sandia Labs., Albuquerque, N. Mex

VERTICAL SAMPLING FLIGHTS IN SUPPORT OF THE 1981 ASCOT COOLING TOWER EXPERIMENTS: FIELD EFFORT AND DATA

G. T. GAY Mar 1982 49 p refs

(Contract DE-AC04-76DP-00789)

(DE82-014269; SAND-82-0172) Avail NTIS HC A03/MF A01

During the month of August 1981, three nights of experimental sampling of tracers released into the cooling tower plume of a geothermal power plant were conducted. In these experiments a tethered balloon was used to lift a payload so as to obtain vertical profiles of the cooling tower plume and the entrained tracers. A description of the equipment used, the field effort and the data acquired are presented here. DOE

N83-21686# Edaw, Inc., Palo Alto, Calif

A COMPARISON OF ESTIMATED AND BACKGROUND SUBSIDENCE RATES IN TEXAS-LOUISIANA GEOPRESSURED GEOTHERMAL AREAS

L. M. LEE, M. CLAYTON, J. EVERINGHAM, R. C. HARDING, and A. MASSA Jun 1982 148 p refs

(Contract DE-AC03-76SF-00098)

(DE83-004095, LBL-14681, GSRMP-13) Avail NTIS HC A07/MF A01

A comparison of background and potential geopressured geothermal development-related subsidence rates is given. Estimated potential geopressured-related rates at six prospects

04 FUELS AND OTHER SOURCES OF ENERGY

are presented. The effect of subsidence on the Texas-Louisiana Gulf Coast is examined including the various associated ground movements and the possible effects of these ground movements on surficial processes. The relationships between ecosystems and subsidence, including the capability of geologic and biologic systems to adapt to subsidence, are analyzed. The actual potential for environmental impact caused by potential geopressured-related subsidence at each of four prospects is addressed. DOE

N83-21694# Pacific Northwest Lab., Richland, Wash.
GEOTECHNICAL PROPERTIES OF PARAHO SPENT SHALE
T. E. GATES. Oct. 1982. 47 p. refs
(Contract DE-AC06-76RL-01830)
(DE83-002633, PNL-4357) Avail: NTIS HC A03/MF A01

A literature review of available geotechnical properties for PARAHO retorted shale was conducted. Also reported are laboratory measurements made at PNL on key hydraulic properties of the PARAHO retorted shale. The PARAHO material can be compacted in the laboratory to dry densities of 12.1 KN/cu m (77.0 pcf) to 17.0 KN/cu m (108.4 pcf) depending on compaction effort. Optimum water content for these densities range from 14.4 to 23.7 percent (dry weight), however, PARAHO can achieve high densities without requiring water for compaction. Water retention characteristics indicate that optimum moisture contents (field capacity) range from 13 to 14% (dry weight). Water contents in excess of these values are likely to drain with time. PARAHO shale can be considered as semipervious to pervious with permeability values of 1000 to 10,000 cm/s depending on compaction effort. PARAHO shale exhibits self-cementing characteristics. Under normal conditions cementing reactions are slow, with strength gains still indicated after 28 days. The shear strength of PARAHO is comparable to similarly graded gravel with effective angles of internal friction, ϕ' , of 33 to 34 degrees. Depending on compactive effort and gradation of the material, effective cohesion values of 0.09 MN/sq m to 0.19 MN/sq m (128.05 psi to 277.45 psi) can be expected. DOE

N83-21701# Kansas State Geological Survey, Lawrence
REGIONAL INTERPRETATION OF KANSAS AEROMAGNETIC DATA
H. L. YARGER. 1982. 104 p. refs
(Contract DE-AS07-79ET-27204)
(DE83-003219; DOE/ET-27204/T1-VOL-1-SECT-3) Avail: NTIS HC A05/MF A01

The aeromagnetic mapping techniques used in a regional aeromagnetic survey of the state are documented and a qualitative regional interpretation of the magnetic basement is presented. Geothermal gradients measured and data from oil well records indicate that geothermal resources in Kansas are of a low-grade nature. However, considerable variation in the gradient is noted statewide within the upper 500 meters of the sedimentary section, this suggests the feasibility of using groundwater for space heating by means of heat pumps. DOE

N83-21702# Science Applications, Inc., Steamboat Springs, Colo.
Applied Geomechanics Div.
STRATIGRAPHIC VARIATIONS IN OIL-SHALE FRACTURE PROPERTIES

C. YOUNG, N. C. PATTI, and B. C. TRENT. Laramie, Wyo.
DOE. Sep. 1982. 78 p. refs
(Contract DE-AP20-82LC-00389)
(DE82-021088, DOE/LC-RI-82-5) Avail: NTIS HC A05/MF A01

The proper design and evaluation of in situ oil shale fracture and retorting experiments which require that both the extreme values and spatial distribution of the controlling rock properties be adequately known are discussed. The prediction, control and evaluation of explosive oil shale fracturing require a detailed knowledge of tensile strength behavior as a function of shale grade and stratigraphic position. Direct pull tensile tests, point load pinch tests, and four point bend fracture toughness tests are utilized to develop detailed logs of the relevant fracture properties for the 37 m thick Mahogany Zone section of the Green River Formation near Anvil Points, Colorado and for the rich, upper 13

m of the Tipton Member near Rock Springs, Wyoming. Statistical analyses were performed on these data and on Fischer assay oil yield data to establish the correlations between them. Data from both tensile strength and fracture energy tests correlate well with lithologic and oil yield characteristics of the Mahogany Zone shale while poor correlations were found for the Tipton shale. DOE

N83-21703# Los Alamos Scientific Lab., N. Mex.
GEOTHERMAL INVESTIGATIONS IN WEST VIRGINIA
R. HENDRY, K. HILFIKER, D. HODGE, P. MORGAN, C. SWANBERG, and S. S. SHANNON, JR. Nov. 1982. 58 p. refs
(Contract W-7405-ENG-36)
(DE83-004480, LA-9558-HDR) Avail: NTIS HC A04/MF A01

Deep sedimentary basins and warm spring systems in West Virginia which are potential geothermal resources are described. A temperature gradient map based on 800 bottom hole temperatures for West Virginia shows that variations of temperature gradient trend northeasterly, parallel to regional structure. Highest temperature gradient values of about 280C/km occur in east central West Virginia, and the lowest gradients (180C/km) are found over the Rome Trough. Groundwater geochemistry indicates that the warm waters circulate in very shallow aquifers and are subject to seasonal temperature fluctuations. Silica heat flow data in West Virginia vary from about 0.89 to 1.4 HFU and generally increase towards the west. Bouguer, magnetic, and temperature gradient profiles suggest that an ancient rift transects the state and is the site of several deep sedimentary basins. DOE

N83-21723# Pacific Northwest Lab., Richland, Wash.
VERTICAL EXTRAPOLATIONS OF WIND SPEED
J. C. DORAN, J. W. BUCK, and S. K. HEFLICK. Sep. 1982. 61 p. refs
(Contract DE-AC06-76RL-01830)
(DE83-000944, PNL-4361) Avail: NTIS HC A04/MF A01

The extrapolation of wind speeds and wind speed distributions from a lower to an upper level is examined, with particular emphasis on the power law approach. While the power laws are useful for representing the behavior of winds under a variety of conditions, they are shown to be inherently incorrect and misleading for extrapolations. The law's apparent simplicity nevertheless makes it attractive for certain purposes, and its performance at a number of windy sites is tested. The principal feature seems to be the large degree of scatter found from site to site, and even at a single site from one time to the next. Part of this is attributable to the effects of stability, as is seen by no means eliminated by this division. The behavior of the power law exponents is poorer still in complex terrain. While some general tendencies of these exponents can be found, their use cannot be recommended for anything more than a preliminary or rough estimate of wind speeds. Extrapolation formulas for Weibull distributions are also tested with the same data base. DOE

N83-21828# Los Alamos Scientific Lab., N. Mex.
USER'S MANUAL FOR HDR3 COMPUTER CODE
C. J. ARUNDALE (New Mexico Univ., Albuquerque). Oct. 1982. 78 p. refs
(Contract W-7405-ENG-36)
(DE83-003993, LA-9560-M) Avail: NTIS HC A05/MF A01

A description of the HDR3 computer code and instructions for its use are provided. HDR3 calculates space heating costs for a hot dry rock (HDR) geothermal space heating system. The code also compares these costs to those of a specific oil heating system in use at the National Aeronautics and Space Administration Flight Center at Wallops Island, Virginia. HDR3 allows many HDR system parameters to be varied so that the user may examine various reservoir management schemes and may optimize reservoir design to suit a particular set of geophysical and economic parameters. DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-21934# Du Pont de Nemours (E. I) and Co., Aiken, S.C. Atomic Energy Div.

RADIOISOTOPES FOR HEAT-SOURCE APPLICATIONS

J. E. HOISINGTON 6 Oct 1982 14 p refs

(Contract DE-AC09-76SR-00001)

(DE83-005045; DPST-82-842) Avail. NTIS HC A02/MF A01

Potential DOD requirements for noninterruptable power sources could total 1 MW thermal by FY 1990. Of the three isotopes considered, Sr-90, Pm-147, Pu-238, Sr-90 is the only one available in sufficient amounts to meet this requirement. To meet the DOD FY 1990 requirements, it would be necessary to undertake Sr-90 recovery operations from spent fuel reprocessing. Strontium 90 recovery from the existing alkaline high level waste (HLW) is not attractive because the isotopic purity of the Sr-90 is below that required for DOD applications. Without reprocessing LWR spent fuel, the demand of 1 MW thermal until FY 1996 could not be met. Strontium-90 is the most economical of the three heat source radionuclides considered. DOE

N83-22336# Brookhaven National Lab., Upton, N. Y. Dept of Energy and Environment

FLASH PYROLYSIS OF BIOMASS WITH REACTIVE AND NON-REACTIVE GASES

M. STEINBERG and P. T. FALLON Jun 1982 22 p refs

Presented at the 14th Biomass Thermochem. Conversion Contractors' Meeting, Arlington, Va 23-24 Jun 1982

(Contract DE-AC02-76CH-00016)

(DE83-001850; BNL-51560) Avail. NTIS HC A02/MF A01

The rapid or flash pyrolysis of wood biomass is being studied in a 1 in. downflow entrained tubular reactor with a capacity of approximately 1 lb/hr of wood. The process chemistry data is being obtained with the view of building a data base and ascertaining the value of producing synthetic fuels and chemical feedstocks by the flash pyrolysis method. Data is being obtained on the effect of nonreactive pyrolyzing gases and the effect of reactive gases, hydrogen for the flash hydrolysis of wood and methane for flash methanolysis of wood. Preliminary process design and analysis has been made. The yield of ethylene and benzene is especially attractive for the production of chemical feedstocks from the reaction of methane and wood in a flash methanolysis process. DOE

N83-22337# Catalytic, Inc., Wilsonville, Ala.

SRC-I SOLVENT-REFINED-COAL PROCESS. OPERATION OF THE SOLVENT-REFINED-COAL PILOT PLANT, WILSONVILLE, ALABAMA Quarterly Technical Progress Report, Apr. - Jun. 1981

Mar 1982 171 p

(Contract DE-AC22-76ET-10154, EPRI PROJ. RP-1234-1-2)

(DE82-009931, DOE/ET-10154/96) Avail. NTIS HC A08/MF A01

Solvent refined coal (SRC-1) pilot plant operated for approximately 81% of the second quarter of 1981. Kentucky 9 coal from the Fies mine was processed in all runs. The following potential process improvements and tests were evaluated in the SRC unit: operation of the new, reduced volume and residence time V103 High Pressure Separator, dissolver temperature and pressure variation studies, evaluation of the hot separator mode of operation, and evaluation of SRC unit reaction section conditions for two-stage liquefaction, in the critical solvent deashing (CSD) unit - steam stripping of SRC to reduce product related deashing solvent (DAS) losses, evaluation of the heated screw and rotary air lock on the continuous ash discharge vessel, equilibrium studies in the first stage, and evaluation of the CSD unit performance at increased feed rates, and in the hydrotreater unit - collection of operating data for preliminary evaluations. DOE

N83-22339# Catalytic, Inc., Wilsonville, Ala.

1980 OPERATION OF SRC PILOT PLANT, WILSONVILLE, ALABAMA Annual Report, Jan. - Dec. 1980

Feb. 1982 198 p refs

(Contract DE-AC22-76ET-10154; EX-76-C-01-2270; EPRI PROJ. 1234-1-2)

(DE82-008323, EPRI-AP-2235) Avail. NTIS HC A09/MF A01

The operating conditions and test results obtained during 1980 at the six ton per day solvent refined coal (SRC-1) pilot plant in Wilsonville, Alabama are discussed. The plant was in operation for the equivalent of 247 days, an on stream factor of 67.7%. Kentucky 9 coals from the Lafayette, Dotiki and Fies mines were processed. During 1980, the operating conditions and equipment were adjusted to evaluate potential process improvements. These experiments produced significant results in the following areas: Operating V103 high pressure separator in the hot mode; varying T102 vacuum column operating temperature, adding light SRC, a product of the third stage of the critical solvent deashing unit, to the process solvent, investigating the effects of the chlorine content of the feed coal on corrosion in the process vessels, and evaluating the effects of adding sodium carbonate on corrosion rates. DOE

N83-22342# Catalytic, Inc., Wilsonville, Ala.

CATALYTIC HYDROGENATION UNIT STUDIES

H. E. LEWIS Nov 1982 102 p refs

(Contract DE-AC22-82PC-50041)

(DE83-003390, DOE/PC-50041/2, TR-4) Avail. NTIS HC A06/MF A01

The ebullated bed hydrotreater is fully operational. This unit was installed to upgrade SRC product, expand the product slate flexibility, and improve hydrogen utilization efficiency. An analysis of the hydrotreater unit operating data is presented. Solvent refined coal was produced from Kentucky 9 (Fies) coal and from Illinois 6 (Burning Star) coal and was processed using a commercially available cobalt-molybdenum hydrosulfurizing catalyst. The unit was operated over a fairly wide range of space velocities (1.1 to 2.2 lb/hr feed per lb catalyst) and reactor temperatures (6500F to 8300F). A total of twenty-six unit material balances, under varying operating conditions, were completed. The daily operating and material balance data were used for analysis and correlation. A three lump first order kinetic model was developed to describe the steady state behavior of the reactor. A catalyst deactivation model based on intrinsic activity, and rate of loss of this activity (separable decay) is proposed. DOE

N83-22350# Department of Energy, Laramie, Wyo. Energy Technology Center

REVERSE-COMBUSTION, HORIZONTAL RETORTING OF OIL SHALE

I. A. JACOBSON, JR. 1982 32 p refs

(DE83-000018, DOE/LC/RI-82/6) Avail. NTIS HC A03/MF A01

Retorting of Green River oil shale by reverse combustion was studied in an adiabatic horizontal retort of approximate 226 kg (500 lb) capacity. The effects of air injection rate, system pressure, steam injection, and outlet temperature of the retort on oil yield and properties and product gas quantity and quality were studied. Product gas from the tests was of low heating value with a relatively high hydrogen and carbon monoxide content in the absence of steam injection. Oil yield was generally less than 50 volume percent of Fischer assay potential due to thermal cracking and possible product combustion. Regression equations are presented to allow estimation of oil yield and properties and product gas properties and compositions based on the retort operating variables. It was found that total usable energy recovery from the raw oil shale could be influenced by changes in test parameters. DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-22351# Department of Energy, Grand Forks, N. Dak Energy Technology Center.

EFFECTS OF SEVERAL DISPOSABLE CATALYSTS ON LIQUEFACTION OF LIGNITE

G. G. BAKER, T. C. OWENS (North Dakota Univ.), and J. R. RINDT (North Dakota Univ) 1982 22 p refs Presented at the Am. Soc of Civil Engrs Ann Meeting, New Orleans, (DE82-022188, CONF-821036-1) Avail: NTIS HC A02/MF A01

Batch and continuous coal liquefaction tests with several iron and sulfur based additives plus coals treated by ion exchange techniques indicate product quality and yields can be significantly influenced with some coals. Generally, it appears iron compounds are required to improve the hydrogen-to-carbon ratio of the product and that H₂S offers promise in maintaining good yields of desired products at reduced liquefaction temperatures and of reducing hydrogen consumption. Treating lignite by ion exchange techniques prior to liquefaction did not give encouraging results. DOE

N83-22353# Monsanto Research Corp., Dayton, Ohio OIL/REFUSE HOMOGENIZATION: AN APPROACH TO COMBUSTION OF REFUSE IN EXISTING OIL-FIRED BOILERS

R. G. BEER and T. E. CTVRTNICEK Feb. 1982 32 p refs (Contract DE-AC01-79CS-20175) (DE82-011848, DOE/CS-20175/1) Avail: NTIS HC A03/MF A01

The feasibility of grinding and mixing one type of pretreated municipal solid waste, refuse derived fuel (RDF), with No. 6 (bunker C) fuel oil to obtain a fuel potentially combustible in existing oil fired boilers was investigated. The feasibility of reducing an RDF 2 inch in size to lumps of which 90% by number were less than 30 millimicrons across and to fibers typically 1000 millimicrons long or less and less than 1 millimicron in diameter was demonstrated using a disc mill. The ground refuse oil (refoil) mix, however, contained deformed metal particles that will require removal to prevent clogging of burner nozzles. Investigations into refoil atomization and metal particle removal and firing the refoil in a pilot, small, or medium size oil fired boiler to establish the refoil atomization and combustion characteristics and the impact of refoil on boiler operation and emissions are recommended. DOE

N83-22354# SRI International Corp., Menlo Park, Calif EXPLORATORY STUDY OF COAL CONVERSION CHEMISTRY Quarterly Report, 19 Nov. 1981 - 18 Feb. 1982

D. S. ROSS, D. F. MCMILLEN, W. C. OGIER, R. BUNNELL, and G. P. HUM Mar. 1982 46 p refs (Contract DE-AC22-81PC-40785) (DE82-013414; DOE/PC-40785/3; QR-3) Avail: NTIS HC A03/MF A01

Data on the rate and mechanisms of radical induced cleavage of strong C-C and C-O bonds in coal structures are given. It was shown that even resonance stabilized radicals, which form relatively weak C-C bonds, can displace other resonance stabilized radicals from methylene bridged coal structures. Kinetic studies reveal that either the self disproportionation of 1,2-dihydronaphthalene is much faster than previously reported or that the 1,2-dihydronaphthalene tetralin disproportionation is much less important as a radical initiation process than thermochemical estimates suggested. Prime 1,2-dinaphthylmethane undergoes radical induced CH₂-Ar bond scission ten times faster than diphenyl ether. This factor is shown to be consistent with the thermochemistry of displacement by tetralyl radical. CO/H₂O conversion of a second, high volatile bituminous coal, PSOC-233 was also studied. With PSOC-026, the initial pH did affect the conversion rate, increasing with higher pH. DOE

N83-22355# Hydrocarbon Research, Inc., Lawrenceville, N. J.

CATALYTIC EVALUATION FOR H-COAL Final Report

A. G. COMOLLI, D. T. A. HUIBERS, E. S. JOHANSON, and C. L. WEBER Mar. 1982 269 p refs (Contract DE-AC22-78ET-10742) (DE82-014457; DOE/FE-10742/44) Avail: NTIS HC A12/MF A01

An improved H Coal catalyst was investigated. A catalyst with an optimum bimodal pore size distribution, and an optimum balance of cracking and hydrogenation functions via the use of promoters was developed. Bench scale unit improvements were made to increase operating reliability, reduce the time required to obtain product analyses, and increase the accuracy and reproducibility of product analyses leading to a better material balance and more accurate calculations of conversion rates. Unit modifications were also made to reduce potential operating problems with fluid flow, reduce loss of light liquid hydrocarbons and other products that might evaporate during operations, and measure of unit material inventories using the DASH computer system. DOE

N83-22356# Illinois Univ., Chicago REVIEW OF HOT-GAS-DESULFURIZATION SIMULATION MODELS

S. C. SAXENA Morgantown, W. Va. DOE Feb. 1982 75 p refs (Contract DE-AC21-81MC-18668) (DE82-016265; DOE/MC-18668/1186) Avail: NTIS HC A04/MF A01

The removal of hydrogen sulfide and other sulfur gaseous compounds from the fuel gas of coal gasification plants using iron and zinc oxides was accomplished with promising success. Associated with this desulfurization process is the problem of regeneration of the metal sulfides formed back to the oxide state for reuse. For the efficient design and optimum operation of process plants, it is imperative that the reaction mechanism for the gas-solid reactions be known as also the gas and solids dispersion and movement in the reactor. In recent years, four mechanistic models were developed and proposed for this purpose. Models intended for use in connection with the noncatalytic gas-solid reactions are briefly described. They are: shrinking core model, homogeneous model, grain model, and pore model. All the four models were employed to mechanistically describe the desulfurization process in a fixed bed of granular metal oxide. DOE

N83-22357# Westinghouse Electric Corp., Pittsburgh, Pa GAS CHARACTERIZATION FROM FLUIDIZED-BED COAL GASIFICATION Quarterly Report, 1 Dec. 1981 - 28 Feb. 1982

D. F. CILIBERTI, E. E. SMELTZER, N. T. ROHATGI, M. A. ALVIN, D. L. KEAIRNS, A. B. TURNER, and F. LAGONIK 1982 30 p (Contract DE-AC21-81MC-16024) (DE82-012396; DOE/MC-16024/T4, QR-2) Avail: NTIS HC A03/MF A01

A proposal to characterize the nature of alkali, trace metal, particulate, and hydrocarbon emissions in the hot fuel gas stream produced in a fluidized bed gasifier. The potential environmental and process implications of these emissions will be studied. The characterization would consist of determining the amounts of contaminants associated with the particulate emissions relative to the amounts and types of gaseous species. The particulate-associated contaminants would be further analyzed to determine their soluble and insoluble fractions as well as the particular species present. The primary method of sampling will be based on isokinetic extractive sampling. Upon analysis of the species and amounts of alkali, trace metal, and hydrocarbons found, attempts will be made to correlate the effects of feedstocks and operating parameters with these emissions. This will be used to develop a basis for projecting emission profiles in fluidized bed gasification processes. DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-22358# Massachusetts Inst. of Tech., Cambridge Energy Lab

COAL-GASIFICATION AND TAR-CONVERSION REACTIONS OVER CALCIUM OXIDE Quarterly Progress Report, 1 Nov. 1981 - 31 Jan. 1982

J P LONGWELL, C S CHANG, and W A PETERS Apr. 1982 11 p refs

(Contract DE-AC21-81MC-16026)

(DE82-014635; DOE/MC-16026/2) Avail NTIS HC A02/MF A01

The major efforts were concentrated on system constructions and development of sampling and analytical procedures. Several preliminary (1)H-NMR and (13)C-NMR spectra of a simulated coal tar sample were obtained. The result of (13)C-NMR spectroscopy shows that reliable quantitative (13)C studies can be achieved through a combination of NMR techniques, i.e., the use of Fourier Transform NMR (FT-NMR), gated proton decoupling, extended time delay between spectrometer scans and the application of paramagnetic species in the sample solution. Important global structural parameters characteristic of different coal tars, such as aromaticity, degree of substitution of aromatic rings, hydrogen distribution, etc., can be determined from data of (1)H-NMR, (13)C-NMR and elemental analysis. DOE

N83-22360# Oak Ridge National Lab, Tenn. Metals and Ceramics Div

COAL-LIQUEFACTION-PLANT FRACTIONATION-COLUMN CORROSION-COUPON STUDIES

J R KEISER, V B BAYLOR, M HOWELL, and J F NEWSOME 1982 32 p refs

(Contract W-7405-ENG-26)

(DE82-007469; ORNL/TM-7933) Avail NTIS HC A03/MF A01

Severe corrosion has been observed in fractionation columns at the Fort Lewis, Washington, and Wilsonville, Alabama, solvent refined coal pilot plants. This corrosion is most severe for materials exposed in the 220 to 260 C (430 to 500 F) range and results in corrosion rates of as much as 6.4 mm/y (250 mils/y) for type 18-8 stainless steels. Studies at ORNL of this corrosion problem include exposure of coupons in the columns, analysis of failed components from the pilot plants, chemical analyses of liquids from the pilot plants, and operation of laboratory experiments. This report describes the coupon exposure studies, gives the results of these studies, and discusses the selection of fractionation column materials on the basis of our experience. The studies show that several high-nickel alloys have corrosion rates of less than 0.25 mm/y (10 mils/y) and would be suitable in a fractionation column environment even if no process changes are made to reduce offending species such as chlorine. DOE

N83-22361# Combustion Engineering, Inc., Windsor, Conn. Power Systems Div

EFFECT OF LIQUEFACTION PROCESSING CONDITIONS ON COMBUSTION CHARACTERISTICS OF SOLVENT-REFINED COAL Interim Report

G J GOETZ, T C LAO, A K MEHTA, and N Y NSAKALA Mar 1982 176 p refs

(Contract EPRI PROJ 1412-9)

(DE82-903665; EPRI-AP-2328) Avail. NTIS HC A09/MF A01

One of several direct liquefaction processes currently under advanced stages of development is the Solvent-Refined Coal-I (SRC-I) process. A major SRC-I product option is a low sulfur, low ash solid (SRC) which could be used as an electric utility boiler fuel much in the same manner that pulverized coal is currently fired in this type of combustion equipment. SRC-I processing was performed using three variations in the manner in which mineral matter and unconverted coal are separated from the hot coal liquid. These processes are the Pressure Filtration Deashing, Anti-Solvent Deashing, and Critical Solvent Deashing. Since processing conditions may influence the combustion of SRC-I solids produced, an experimental program was carried out at both the bench and pilot plant scale to determine the influence of processing (i.e., solids separation method) and combustion conditions on

carbon burnout of these three varieties of SRC solid boiler fuels. DOE

N83-22362# Texaco, Inc., El Monte, Calif.

ENRICHED-AIR AND OXYGEN GASIFICATION OF ILLINOIS NO. 6 COAL IN A TEXACO COAL-GASIFICATION UNIT

W B CROUCH, G N RICHTER, and E W DILLINGHAM Feb 1982 40 p

(Contract EPRI PROJ 985)

(DE82-903133; EPRI-AP-2214) Avail NTIS HC A03/MF A01

Four runs were made with Illinois No. 6 coal to demonstrate technology to integrate the coal gasification process in an environmentally acceptable manner with gas turbines for combined cycle electric power generation. Operability and response of the gasifier and a Selexol acid gas removal unit were demonstrated during load changes utilizing both oxygen and enriched air as oxidants (transient runs). Steady state performance data on the gasifier, Selexol unit and gas turbine combustor were obtained at a variety of oxygen to coal ratios at different production rates utilizing each oxidant (steady state runs). Essentially no effect of charge rate on the syngas quality was noted. Environmental base line data were gathered for both oxidants. DOE

N83-22363# State Univ. of New York, Buffalo

CATALYTIC COAL LIQUEFACTION Quarterly Report, Jan. - Mar. 1982

S. W. WELLER 1982 31 p refs

(Contract DE-FG22-81PC-40781)

(DE82-012562; DOE/PC-40781/T2, FE-2013-19) Avail NTIS HC A03/MF A01

A review was written covering the use of molybdenum catalysts, both unsupported and supported, in coal liquefaction. When unsupported molybdenum compounds are used in a once-through mode, the degree of dispersion becomes very important, in this respect molybdenum catalysts differ from the tin-halogen acid system for coal liquefaction. Supported catalysts, such as MoO₃/CoO/Al₂O₃, become deactivated when used in fixed-or ebullating-bed processes. The deactivation results largely from deposition of coke and metals in pores, but there is evidence also for the formation, migration, and crystallite growth of MoS₂ during extended use of supported catalysts. Some of the early results on coal liquefaction with molybdenum catalysts in Germany and at the Bureau of Mines are reviewed, along with more recent laboratory experiments. Emphasis is placed on the problems of understanding the chemical role of catalysts in liquefaction. DOE

N83-22366# Los Alamos Scientific Lab., N. Mex.

CATALYTIC COAL CONVERSION SUPPORT. USE OF LASER FLASH-PYROLYSIS FOR STRUCTURAL ANALYSIS Progress Report, 15 Apr. 1979 - 30 Sep. 1981

W. J. VERZINO, JR., C. K. ROFER-DEPOORTER, and R. E. HERMES Mar 1982 74 p refs

(Contract W-7405-ENG-36)

(DE82-014124; LA-9269-PR) Avail. NTIS HC A04/MF A01

Untreated Fruitland subbituminous coal and Fruitland coal treated with several gasification catalysts were pyrolyzed with both Nd-glass and CO₂ lasers to give both gaseous and intermediate molecular weight products, which were analyzed by gas chromatography (GC) and gas chromatography mass spectrometry (GC-MS). The catalysts used were AlCl₃, K₂H₂Sb₂O₇, COCl₂, PbCl₂, Pb(NO₃)₂, Na₂Pb(OH)₆, Na₂MoO₄, NiCl₂, K₂CO₃, KHCO₃, Na₂CO₃, NaHCO₃, Na₂Ti₃O₇, NaVO₃, ZnCl₂, and NaZn(OH)₃. Gaseous products were analyzed from the Nd-glass laser pyrolysis of the various catalysts, ZnCl₂ was found to affect N₂ production during pyrolysis most significantly. Intermediate products were analyzed from the CO₂ laser pyrolysis, product distribution was found to depend upon particle size (and consequent thermal history in pyrolysis) as well as on catalyst and heat treatment. DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-22367# Spectron Development Labs, Inc., Costa Mesa, Calif

PARTICULATE PROCESSES IN PULVERIZED-COAL FLAMES **Quarterly Technical Progress Report, Nov. - Jan. 1982**

Jan 1982 22 p refs

(Contract DE-AC22-80PC-30300)

(DE82-014306; SDL-82-2177-29Q) Avail NTIS HC A02/MF

A01

Major attention was focused on the characterization of pulverized coal particles and on the performance testing of both the open burner and the furnace burner. The axial temperature distributions of both burners were mapped. The axial temperature decay varied between 250 and 500 K per meter. This is to be compared with the design goal of 200 K per meter but is considered satisfactory for our experimental requirements. Holographic investigation of coal decomposition was initiated during this period but was limited to the open burner. However, in order to produce a coherent observation of the decomposition phenomenology, the holographic results are purposely excluded and will be incorporated into a later report pending the completion of holographic experiments with the furnace burner. DOE

N83-22380# SRI International Corp., Menlo Park, Calif
Membrane Separation Program
DEVELOPMENT AND DEMONSTRATION OF A
REVERSE-OSMOSIS ENERGY-RECOVERY DEVICE Final Report

G. B. ANDEEN and J. C. EID Jun 1982 44 p refs

(Contract DI-14-34-0001-1403)

(PB83-108605, W83-00256, OWRT-C-00146-D(1403)(1)) Avail

NTIS HC A03/MF A01 CSCL 07D

An energy recovery device for a seawater reverse osmosis (RO) system was designed, fabricated, and tested. The device, comprised of a valving system, uses waste streams from an RO system to drive a pump which, in turn, sends additional feed flows to the RO elements. Test data demonstrated that efficiencies exceeding 95% can be expected, and, hence, energy consumption in a seawater RO desalination system can be decreased by 50%. Further, conversion may be decreased from 30% in order that membrane life is extended, and the size of the main pump and prime mover can be reduced by 50%. The device was subjected to almost 1000 hours (175,000 cycles) of testing, simulating its operation in a 4800 gallon/day seawater system, producing an outlet pressure of over 850 lbs/sq in for an inlet pressure of 750 lbs/sq in. GRA

N83-22436# Florida Univ., Gainesville

SYNTHESIS AND CHARACTERIZATION OF NOVEL POLYMERS **FROM NON-PETROLEUM SOURCES FOR USE IN ENHANCED** **OIL RECOVERY** Progress Report, 1 Jul. 1981 - 30 Jun. 1982

G. B. BUTLER and T. E. HOGEN-ESCH 1982 32 p refs

(Contract DE-AS05-78ER-05947)

(DE82-008705, DOE/ER-05947/3) Avail NTIS HC A03/MF

A01

Synthesis and structural characterization of polysaccharide-based graft copolymers for use in tertiary oil recovery, determination of physical properties of the polymers and their solutions, and screening of the polymers to determine their utility in oil recovery were discussed. Synthesis and characterization have continued in the following five areas: starch-g-polyacrylamide (ST-g-PAM) copolymers, graft copolymers of other polysaccharides and acrylamides, a naturally occurring polysaccharide extracted from okra (Akro), graft copolymers of Schardinger-beta-dextrin and acrylamide (SD-g-PAM), chemical degradation of ST-g-PAM and SD-g-PAM copolymers. The following areas were investigated: characterization of copolymers by ultracentrifugation, size exclusion chromatography and nucleophore membrane filtration, rheological studies on copolymers, and statistical analysis of variables in graft copolymerization. DOE

N83-22439*# Science Applications, Inc., Chatsworth, Calif
Combustion Science and Advanced Technology Dept.

REVIEW OF ALTERNATIVE FUELS DATA BASES Final Report

P. T. HARSHA and R. B. EDELMAN Jan 1983 130 p refs

(NASA-CR-170203, NAS 1 26-170203, SAI-83-045-CHA) Avail:

NTIS HC A07/MF A01 CSCL 21D

Based on an analysis of the interaction of fuel physical and chemical properties with combustion characteristics and indicators, a ranking of the importance of various fuel properties with respect to the combustion process was established. This ranking was used to define a suite of specific experiments whose objective is the development of an alternative fuels design data base. Combustion characteristics and indicators examined include droplet and spray formation, droplet vaporization and burning, ignition and flame stabilization, flame temperature, laminar flame speed, combustion completion, soot emissions, NO_x and SO_x emissions, and the fuels' thermal and oxidative stability and fouling and corrosion characteristics. Key fuel property data is found to include composition, thermochemical data, chemical kinetic rate information, and certain physical properties. S. L.

N83-22440# Institut de Recherche des Transports, Arcueil (France). Centre d'Evaluation et de Recherche des Nuisances et de l'Energie

MOTOR-FUELS FOR ROAD VEHICLES

J. DELSEY, J. LAMBERT, and A. FRYBOURG Nov 1982 65 p

refs In FRENCH, ENGLISH summary

(REPT-24) Avail NTIS HC A04/MF A01

The different motor fuels used by road vehicles (super, gasoline, diesel oil, liquefied petrol gas,...) are defined. The different entries of energy consumption associated with the use and the manufacturing of the vehicle, as well as road construction and road maintenance are studied. The different existing methods of refining petrol are reviewed, followed by a study of the different techniques designed to adjust the qualities of motor fuels to the needs of the vehicles. The energy cost of motor fuel manufacturing is also mentioned. The different problems raised by substitution motor fuels are reviewed (alcohol, synthetical motor fuels, ...). S. L.

N83-22442*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio

AVIATION GASOLINES AND FUTURE ALTERNATIVES

D. J. PATTERSON, ed. Washington May 1983 164 p refs

Workshop held in Cleveland, Ohio, 3-5 Feb 1981

(NASA-CP-2267; E-1260, NAS 1 55 2267) Avail NTIS HC

A08/MF A01 CSCL 21D

General aviation industry needs and directions, fuel supply/demand issues, and general aviation technology prospects are discussed.

N83-22445*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio

INDUSTRY'S ASSESSMENT OF THE NUMBER OF AIRPLANES **IN THE GENERAL AVIATION FLEET ALONG WITH THEIR** **HOURS FLOWN AND FUEL CONSUMPTION DATA POWERED** **BY WHAT TYPE OF ENGINES, WHEN AND FOR WHAT** **REASONS, THROUGH THE YEAR 2000**

T. J. SMITH (Mooney Aircraft) In its Aviation Gasolines and Future Alternatives p 15-32 May 1983

Avail NTIS HC A08/MF A01 CSCL 21D

The future of general aviation, its fuels, and the piston powered fleet of aircraft up to the year 2000, and beyond are considered.

Author

04 FUELS AND OTHER SOURCES OF ENERGY

N83-22446*# Michigan Univ., Ann Arbor
LIGHTWEIGHT AIRCRAFT ENGINES, THE POTENTIAL AND PROBLEMS FOR USE OF AUTOMOTIVE FUELS

D J PATTERSON /in NASA. Lewis Research Center Aviation Gasolines and Future Alternatives p 39-44 May 1983 Original document was announced as N81-18057
Avail NTIS HC A08/MF A01 CSCL 21D

A comprehensive data research and analysis for evaluating the use of automotive fuels as a substitute for aviation grade fuel by piston-type general aviation aircraft engines is presented. Historically known problems and potential problems with fuels were reviewed for possible impact relative to application to an aircraft operational environment. This report reviews areas such as: fuel specification requirements, combustion knock, preignition, vapor lock, spark plug fouling, additives for fuel and oil, and storage stability
Author (GRA)

N83-22448*# Phillips Petroleum Co., Bartlesville, Okla
MANUFACTURING COMPARISONS OF AVIATION AND MOTOR GASOLINES

L O MEYER /in NASA. Lewis Research Center Aviation Gasolines and Future Alternatives p 51-59 May 1983
Avail NTIS HC A08/MF A01 CSCL 21D

The manufacturing of avgas is compared with that of autogas.
Author

N83-22449*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
FUEL SUPPLY AND DISTRIBUTION. FIXED BASE OPERATION

L C BURIAN (National Air Transportation Association) /in its Aviation Gasolines and Future Alternatives p 63-67 May 1983
Avail. NTIS HC A08/MF A01 CSCL 21D

Aviation gasoline versus other products, a changing marketplace, the Airline Deregulation Act of 1978, aviation fuel credit card purchases, strategic locations, storage, co-mingling of fuel, and transportation to/from central storage are discussed
Author

N83-22450*# Teledyne Continental Motors, Mobile, Ala Aircraft Products Div
THE SPARK-IGNITION AIRCRAFT PISTON ENGINE OF THE FUTURE

K J STUCKAS /in NASA. Lewis Research Center Aviation Gasolines and Future Alternatives p 75-87 May 1983
Avail NTIS HC A08/MF A01

The advanced technology, spark ignition, aircraft piston engine design study was conducted to determine the improvements that could be made by taking advantage of technology that could reasonably be expected to be made available for an engine intended for production by January 1, 1990. Two engines were proposed to account for levels of technology considered to be moderate risk and high risk. The moderate risk technology engine is a homogeneous charge engine operating on avgas and offers a 40% improvement in transportation efficiency over present designs. The high risk technology engine, with a stratified charge combustion system using kerosene-based jet fuel, projects a 65% improvement in transportation efficiency. Technology enablement program plans are proposed herein to set a timetable for the successful integration of each time of required advanced technology into the engine design
Author

N83-22453*# Garrett Turbine Engine Co., Phoenix, Ariz
FUTURE OF ALTERNATE FUELS FOR TURBINE ENGINES
H SCHELP /in NASA. Lewis Research Center Aviation Gasolines and Future Alternatives p 107-121 May 1983
Avail NTIS HC A08/MF A01 CSCL 21D

The fuel property variations that were identified to be of concern with the utilization of alternate fuels for aircraft turbine engines are related to the potential problem areas
Author

N83-22461# E-F Technology, Inc., St. Johns, Mich.
THE ALTERNATIVE FUELS FOR MEDIUM SPEED DIESEL ENGINES (AFFMSDE) PROJECT: A BASELINE PROGRAM PLANNING CONCEPT FOR REVIEW AND REVISION Final Report

Jun 1982 43 p refs
(Contract DE-AC02-81CS-50048)
(DE83-002565; DOE/CS-50048/T1) Avail NTIS HC A03/MF A01

Suggestions and recommendations for the long term continuation of the Alternative Fuels for Medium Speed Diesel Engines (AFFMSDE) Program as program support transitions from government to industry were suggested. Identification of the means of conserving railway used petroleum resources through the use of petroleum based fuels with properties deviating significantly from conventional specification diesel fuels and/or through the use of fossil fuels not derived from petroleum was examined. The Multi-Year approach to Program Management Planning presented here is a suggested baseline concept. If it is subjected to review, revision, and expansion in detail by all program participants, it might provide some assistance in developing long-term, planned, support, and continuity of management that programs of this type require.
B.G.

N83-22462# Minnesota Univ., St. Paul. Dept of Agricultural Engineering.

ALTERNATIVE ENGINE FUELS: EDUCATIONAL DEMONSTRATION PROJECT Final Report

J A TRUE 15 Dec 1982 9 p
(Contract DE-FG02-81R5-10316)
(DE83-004579; DOE/R5-10316-T1) Avail: NTIS HC A02/MF A01

The purpose was to produce four educational tools: two portable engine demonstration trailers that show the operational characteristics of a spark ignition engine and a diesel engine burning various alternative fuels, a 16 mm movie of the several engine fuel demonstrations for use in physical situations where the actual demonstrations cannot be given; Agricultural Extension Service bulletins describing the operation of engines on alternative fuels, and construction plans and procedures for use by others in assembling similar demonstrations. The 2 trailers, one with a spark-ignition engine-generator set, one with a diesel engine-generator set, were built and demonstrated at 9 farm meetings with about 1500 people attending. A single 12-minute 16 mm film on the use of ethanol and sunflower oil as alternate fuels was produced and is available for public use. A paper titled Alternative Engine Fuels Demonstration and Materials Test was presented at a meeting of Agricultural Engineers and is available
DOE

N83-22464# Texas A&M Univ., College Station. Agricultural Experiment Station

ECONOMIC AND ENGINEERING EVALUATION OF PLANT OILS AS A DIESEL FUEL Final Report

C. R. ENGLER, W. A. LEPORI, L. A. JOHNSON, R. C. GRIFFIN, K. C. DIEHL, D. S. MOORE, R. D. LACEWELL, C. G. COBLE, E. W. LUSAS, and E. A. HILER 15 Apr. 1982 160 p refs
(Contract TENRAC PROJ. 80-B-4-4A)
(DE83-900805; TENRAC/EDF-065) Avail: NTIS HC A08/MF A01

The annual total yield of plant oils in the US is about 3.7 billion gallons. Diesel use by agriculture is about 2.0 billion gallons annually and is growing rapidly relative to gasoline use. Based on these amounts, plant oils could satisfy agriculture's diesel fuel requirements during the near future. However, diversion of large quantities of plant oils for such purposes would have dramatic impacts on plant oil prices and be reflected in numerous adjustments throughout agriculture and other sectors of the economy. The competitive position of sunflowers for plant oil production in Texas was analyzed. In those regions with a cotton alternative, sunflowers were not, for the most part, economically competitive. However, sunflowers production is competitive with grain sorghum in certain cases. To develop a meaningful production

04 FUELS AND OTHER SOURCES OF ENERGY

base for oilseed crops in Texas, yields need to be improved or increases in oilseed prices relative to cotton must take place. This implies some limitations for the potential of Texas to produce large quantities of plant oils. DOE

N83-22466# California Univ., Livermore. Lawrence Livermore Lab.

THE HFEM MONITORING OF COAL GASIFICATION: RAWLINS, WYOMING

E. F. LAINE, N. J. CHAKAKIS, W. D. DAILY, F. J. DEADRICK, G. HOLLADAY, and K. I. KISHIYAMA 24 Mar. 1982 21 p refs (Contract W-7405-ENG-48)

(DE82-013801, UCID-19363) Avail NTIS HC A02/MF A01

This report covers the high frequency electromagnetic monitoring (HFEM) of an underground coal gasification test located in the North Knobs area about eight miles west of Rawlins, Wyoming in Section II T21N, R89W. At the test site, the gasified coal seam is steeply dipping (63 deg) with a seam width of about 23 feet. The coal is subbituminous. The purpose of the HFEM is to monitor the burn or cavity progress between the injection well and the production well. Unfortunately, all the boreholes did not extend far enough through the coal seam to allow viewing of the bottom portion of the coal seam. Two key boreholes failed prior to initiation of the burn and became unusable. The results of monitoring with the available boreholes are given. DOE

N83-22467# Aerospace Corp., El Segundo, Calif. Energy Conservation Directorate.

ASSESSMENT OF METHANE-RELATED FUELS FOR AUTOMOTIVE FLEET VEHICLES. VOLUME 2: TECHNICAL, SUPPLY AND ECONOMIC ASSESSMENTS

Feb. 1982 244 p refs 3 Vol

(Contract DE-AC01-80CS-50179)

(DE82-013287, DOE/CE-50179/1-VOL-2) Avail NTIS HC A11/MF A01

The use of methane related fuels, derived from a variety of sources, in highway vehicles is assessed. Methane, as used here, includes natural gas (NG) as well as synthetic natural gas (SNG). Methanol is included because it can be produced from NG or the same resources as SNG, and because it is a liquid fuel at normal ambient conditions. Technological, operational, efficiency, petroleum displacement, supply, safety, and economic issues are analyzed. In principle, both NG and methanol allow more efficient engine operation than gasoline. In practice, engines are at present rarely optimized for NG and methanol. On the basis of energy expended from resource extraction to end use, only optimized LNG vehicles of total petroleum based highway vehicle fuel could be displaced by large fleets with central NG fueling depots. DOE

N83-22468# Aerospace Corp., El Segundo, Calif.

ASSESSMENT FOR METHANE-RELATED FUELS FOR AUTOMOTIVE FLEET VEHICLES. VOLUME 3: APPENDICES

Feb. 1982 252 p refs 3 Vol

(Contract DE-AC01-80CS-50179)

(DE82-013190, DOE/CE-50179/1-VOL-3) Avail NTIS HC A12/MF A01

Fuel composition and properties, operating characteristics of compressed natural gas, liquid natural gas, and methanol vehicles; production technology for natural gas, synthetic natural gas, and methanol, and review comments from outside sources such as automobile manufacturers, US agencies, and research laboratories relative to issues related to the use of methanol fuels and natural gas in US automobiles. DOE

N83-22470# General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept.

MARINE BIOMASS: NEW YORK STATE SITE AND SPECIES STUDY COMPOSITIONAL ANALYSIS AND SYSTEMS STUDIES Final Report, Mar. - Dec. 1981

R. W. MAKINEN, K. M. FARLEY, and W. R. KUGLER Feb 1982 119 p refs

(PB83-126078, GRI-81/0096) Avail: NTIS HC A06/MF A01 CSCL 21D

The primary objective of the marine biomass programs is to provide an optimized, integrated process for producing methane from seaweeds cultivated in the open ocean and to do so at a price which is competitive with that of methane from other sources. The New York State Site and Species Study represents the first evaluation of a site outside of Southern California. It was concluded that two species would be required to assure year round operation. Since the different species being considered have different chemical compositions, this could create significant digestion problems during the changeover period. GRA

N83-22568# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div

BOUNDARY-LAYER CONTROL BY MEANS OF STRONG INJECTION Thesis

R. J. YANG Feb. 1982 63 p refs

(Contract DE-AC03-76SF-00098)

(DE82-012547; LBL-13807) Avail NTIS HC A04/MF A01

The gas mixture produced by a coal gasifier contains components which have serious corrosive effects on the walls of the pipe flow system. To reduce these, a noncorrosive gas is injected into the stream of the coal gas products, in a direct parallel to the pipe wall. The interaction between the injected stream and the original pipe flow is investigated analytically and is an example of the so-called Wall Jet Problem. The model adopted is that of a two-dimensional incompressible turbulent free mixing layer, with the corrosive gas H₂S forming the upper stream and moving faster than the injected non-corrosive gas in the lower stream, the latter bounded by the solid wall of the pipe. This wall jet flow can be divided into three distinct regions. DOE

N83-22594# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)

IGNITION TECHNIQUE FOR CONVENTIONAL MOTORS BY HIGH ENERGY SPARK M.S. Thesis - Aug. 1982 [TECNICA DE IGNICAO EM MOTORES CONVENCIONAIS POR CENTELHA DE ALTA ENERGIA]

H. D. S. COUTO Feb. 1983 66 p refs In PORTUGUESE, ENGLISH summary

(INPE-2645-TDL/116) Avail NTIS HC A04/MF A01

The design, construction, use and testing of a capacitive constant high energy output electronic ignition which is associated with variable gap spark plugs is discussed. Its use was studied in a VW 1500 engine and results are presented in graphs of power vs air fuel ratio. The advantages over the conventional system for lean mixture limit extension, the improvement of fuel burning conditions and the satisfactory burning of low grade fuels are discussed. EAK

N83-22672# New Mexico Energy and Minerals Dept., Santa Fe Energy and Minerals Dept.

ENERGY RESOURCES IN NEW MEXICO: OIL AND GAS, COAL, ELECTRICAL GENERATION, URANIUM, AND GEOTHERMAL ENERGY Annual Resources Report

1982 98 p refs

(DE83-900485, NP-3900485) Avail NTIS HC A05/MF A01

The resource data of New Mexico (oil and gas, coal, electrical generation, uranium, and geothermal) were surveyed and reviewed. Each resource area was further described by means of production, reserves, prices, consumption, transportation, employment, and revenue statistics over the past ten years.

04 FUELS AND OTHER SOURCES OF ENERGY

N83-22675# New Mexico Energy and Minerals Dept., Santa Fe.
COAL

In its Energy Resources in New Mexico p 37-46 1982
Avail NTIS HC A05/MF A01

Coal production occurs in only two basins-the San Juan and Raton Basins. The most significant coal-bearing formations are found in the San Juan Basin (where more than 90 percent of New Mexico's coal is produced). The quality of coal ranges from high-heat content, coking-quality bituminous coal to non-coking, lower rank subbituminous coal. In addition, the coal is generally low in sulfur content, with wide variations in ash and moisture content from field to field. B.G.

N83-22676# New Mexico Energy and Minerals Dept., Santa Fe.
ELECTRICAL GENERATION

In its Energy Resources in New Mexico p 47-59 1982
Avail NTIS HC A05/MF A01

Although electricity is not a natural resource in the sense of coal or oil and gas, the electric utility industry is an integral part of the energy sector of the economy. Electricity is derived by converting one type of energy resource (oil, gas, coal, uranium) into a usable energy form (electricity) and thus has unique properties as a source of energy for the end user. Electrical energy, however, is not only important to New Mexico because electric utilities consume a portion of the natural gas and a large portion of coal resources extracted in the state, but also because electricity affects industrial growth in both the energy and non-energy sectors of the state's economy. B.G.

N83-22677# New Mexico Energy and Minerals Dept., Santa Fe.
URANIUM

In its Energy Resources in New Mexico p 60-78 1982
Avail NTIS HC A05/MF A01

Reserves are uranium resources which occur in known deposits of such grade, quality, configuration, and depth that they are recovered at a cost less than an equal or fixed value through the use of the state of the art mining and processing technologies. Uranium reserves are classified according to categories based on the maximum cost required to extract a pound of uranium concentrate (U3O8). Uranium mines and mill capacity were also discussed. B.G.

N83-22678# New Mexico Energy and Minerals Dept., Santa Fe.
GEOTHERMAL

In its Energy Resources in New Mexico p 77-96 1982 refs
Avail NTIS HC A05/MF A01

New Mexico's geothermal resource potential, as exhibited in more than 300 known thermal springs and wells, exists primarily in association with Quaternary faulting, such as along the Rio Grande rift, or in association with Quaternary volcanic activity. Detailed areas and sites of geothermal prospects having potential for both electrical and thermal uses are listed. Considerable amounts of geological, hydrological, electrical resistivity, gravity, magnetic, seismic, water and subsurface temperature data have been compiled and analyzed. B.G.

N83-22697# Kansas Univ., Lawrence.
ASSESSMENT OF THE GEOTHERMAL RESOURCES OF KANSAS. VOLUME 2: APPENDICES, SECTION 3

Jun. 1982 90 p 2 Vol
(Contract DE-AS07-79ET-27204)
(DE83-003222; DOE/ET-27207/T1-VOL-2-SECT-3) Avail. NTIS HC A05/MF A01

Regression analyses of thermal gradients computed for 1980 and 1981 with respect to unconsolidated sediments and with respect to water tables in Kansas are given. DOE

N83-22698# Kansas Univ., Lawrence.
ASSESSMENT OF THE GEOTHERMAL RESOURCES OF KANSAS. VOLUME 2: APPENDICES, SECTION 4

Jun. 1982 68 p 2 Vol
(Contract DE-AS07-79ET-17104)
(DE83-003215; DOE/ET-27204/T1-VOL-2-SECT-4) Avail. NTIS HC A04/MF A01

Correction factor analysis, repeatability study of control well, and an analysis of thermal logging method are presented. Thermal data for some deep wells in Kansas are also included. DOE

N83-22738# British Library Lending Div., Boston Spa (England).
POSSIBILITIES OF IMPROVING DEGREE OF PERFECTION AND EFFECTIVENESS OF USE OF SECONDARY THERMAL ENERGY RESOURCES

L. S. GORNOSTAEV, F. N. DEMCHENKO, E. A. DRACHENIN, and N. I. ZHIDKOV 20 Dec. 1982 11 p Transl. into ENGLISH from Stal (USSR), no. 12, 1981 p 18-21
(BLL-M-26859-(5825.4)) Avail: British Library Lending Div., Boston Spa, Engl.

A thorough examination is made of the most rational methods of improving the effectiveness of secondary thermal energy resources (STER) within a district-heating system centered on an integrated iron- and steelworks (IISW). STER must not be utilized haphazardly, but in an extremely rational fashion to give greatest possible fuel efficiency. In particular, supplanting the heat from the turbine bleeds of central heating-and-power-secondary steam power plants (EGP-SGP), which reduces the production economy of electrical and mechanical power, is acceptable only in special cases. The main trend in the utilization of STER at a works with full processing cycle should, owing to the particular characteristics of its energy balance, lie in the direction of heating power, namely in district-heating system turbines. The STER steam parameters of many heat raising plants should be raised to power-parameter values, the costs of such practice being defrayed within a year. Author

N83-22750*# Gulf Research and Development Co., Pittsburgh, Pa. Chemicals and Minerals Div.

FUEL QUALITY-PROCESSING STUDY. VOLUME 1: OVERVIEW AND RESULTS Final Report

G. E. JONES, JR. May 1982 66 p 4*Vol.
(Contract DEN3-175; DE-AJ01-77ET-13111)
(NASA-CR-165326-VOL-1; DOE/NASA/DEN-175-1-VOL-1, NAS 1.26.165326-VOL-1, GR/DC-625RN209-VOL-1) Avail: NTIS HC A04/MF A01 CSCL 10B

The methods whereby the intermediate results were obtained are outlined, and the evaluation of the feasible paths from liquid fossil fuel sources to generated electricity is presented. The segments from which these paths were built are the results from the fuel upgrading schemes, on-site treatments, and exhaust gas treatments detailed in the subsequent volumes. The salient cost and quality parameters are included. Author

N83-22751*# Gulf Research and Development Co., Pittsburgh, Pa. Chemicals and Minerals Div.

FUEL QUALITY-PROCESSING STUDY. VOLUME 2: LITERATURE SURVEY Final Report

G. E. JONES, JR., R. AMERO, B. MURTHY, and M. CUTRONE Oct. 1981 147 p refs 4 Vol.
(Contract DEN3-175; DE-AJ01-77ET-13111)
(NASA-CR-165326-VOL-2, DOE/NASA/DEN-175-1-VOL-2; NAS 1.26.165326-VOL-2; GR/DC-625RL137-VOL-2) Avail. NTIS HC A07/MF A01 CSCL 10B

The validity of initial assumptions about raw materials choices and relevant upgrading processing options was confirmed. The literature survey also served to define the on-site (at the turbine location) options for fuel treatment and exhaust gas treatment. The literature survey also contains a substantial compilation of specification and physical property information about liquid fuel products relevant to industrial gas turbines. Author

04 FUELS AND OTHER SOURCES OF ENERGY

N83-22754*# Gulf Research and Development Co., Pittsburgh, Pa Chemical and Minerals Div
FUEL QUALITY/PROCESSING STUDY. VOLUME 3: FUEL UPGRADING STUDIES Final Report

G. E. JONES, JR., P BRUGGINK, and C SINNETT Oct. 1981
195 p refs

(Contract DEN3-175; DE-AI01-71ET-13111)

(NASA-CR-165326-VOL-3; DOE/NASA/DEN-175-1-VOL-3; NAS 1.26:165326-VOL-3, GRDC-625-RL-153-VOL-3) Avail: NTIS HC A09/MF A01 CSCL 10B

The methods used to calculate the refinery selling prices for the turbine fuels of low quality are described. Detailed descriptions and economics of the upgrading schemes are included. These descriptions include flow diagrams showing the interconnection between processes and the stream flows involved. Each scheme is in a complete, integrated, stand alone facility Except for the purchase of electricity and water, each scheme provides its own fuel and manufactures, when appropriate, its own hydrogen S L

N83-22760# University of South Florida, St. Petersburg. Dept. of Marine Science

WORKSHOP REPORT ON BASIC RESEARCH IN ORGANIC GEOCHEMISTRY APPLIED TO NATIONAL ENERGY NEEDS

Jan 1982 129 p refs Workshop held in St. Petersburg, Fla., 15-17 Dec 1980; sponsored by NAS-NRC and DOE (DE82-007074; CONF-801249) Avail: NTIS HC A07/MF A01

Basic research is carried out in basic geochemistry as it relates to the country's energy needs. The exploration, exploitation and environmental impact problems associated with the production and utilization of natural and synthetic carbonaceous fuels are discussed Recommendations are given for these problems.

N83-22762# Geological Survey, Menlo Park, Calif.

EXPLORATION DELIBERATIONS

W STAHL (Federal Inst. on Geoscience and Natural Resources) and K KVENVOLDEN In Univ South Florida Workshop Rept. on Basic Res in Org Geochem Appl to Natl Energy Needs p 9-16 Jan. 1982 refs

Avail: NTIS HC A07/MF A01

Of the many directions that organic geochemistry could take relative to the solution of problems in petroleum exploration, three appear to have the greatest promise Basic organic geochemical research in the areas of migration, kerogen, and depositional model systems should yield the most significant results relative to national energy needs. Migration of petroleum is one of the least understood phenomena in petroleum geology. New information in this area should increase the ability of explorationists to predict where petroleum has moved in the subsurface and where it now resides Kerogen is the dispersed, insoluble organic matter in sedimentary rocks that is a basic substance in petroleum generation. Increased knowledge of its origin, composition, and alteration could be particularly valuable to explorationists. Depositional model systems combine the geologic framework with petroleum geochemistry to yield predictive models for understanding petroleum occurrence.

Author

N83-22763# Shell Development Co., Houston, Tex

EXPLOITATION DELIBERATIONS

J. R. CASTANO In Univ. of South Florida Workshop Rept. on Basic Res. in Org. Geochem Appl. to Natl Energy Needs p 17-20 Jan. 1982

Avail: NTIS HC A07/MF A01

Responsible exploitation of our natural carbonaceous fuels must necessarily be founded in basic organic geochemical research. The greatest impact could be made by directing basic research towards three important areas (1) the chemical structure of coal; (2) the non-thermal recovery of oil from heavy oil sands, and (3) the utilization of soil shale. These research areas are discussed in detail. B.W.

N83-22765# Woods Hole Oceanographic Institution, Mass.

PROBLEMS IN ORGANIC GEOCHEMISTRY APPLIED TO PETROLEUM EXPLORATION AND PRODUCTION

J M HUNT In Univ of South Florida Workshop Rept on Basic Res in Org Geochem Appl. to Natl Energy Needs 33 p Jan 1982 refs

Avail: NTIS HC A07/MF A01

This overview is an outline of some areas where basic studies are needed to improve the discovery and utilization of oil and gas Topics discussed include hydrocarbon detection, sediments, gas origin, gas seepage and sea water analysis B.W

N83-22766# California Univ, Livermore Lawrence Livermore Lab.

UTILIZATION OF OIL SHALES AND BASIC RESEARCH IN ORGANIC GEOCHEMISTRY

A K. BURNHAM In Univ of South Florida Workshop Rept. on Basic Res in Org Geochem Appl to Natl Energy Needs 10 p Jan 1982 refs

Avail: NTIS HC A07/MF A01

Summarized are current research needs relating to oil shale utilization which might also provide new insight into the organic geochemistry of the Green River formation There are two general topics which cross boundaries and are particularly worthy of emphasis. The first is a study of changes in the kerogen structure and biological markers with depth and location, and how these changes affect the pyrolysis products This information would be particularly useful to the retort diagnostic methods It might also lead to a better chemical reaction model of diagenesis and metagenesis. The second is a study of the heteroatom chemistry of the kerogen and how it relates to mineral matter and trace metals This would be useful not only to present utilization methods, but also might suggest new nonthermal methods of organic material recovery B.W

N83-22767# Pennsylvania State Univ, University Park. Coll of Earth and Mineral Sciences

THE RELEVANCE OF COAL GEOCHEMISTRY TO COAL UTILIZATION

P. H. GIVEN In Univ. of South Florida Workshop Rept on Basic Res in Org Geochem. Appl to Natl. Energy Needs 26 p Jan 1982 refs

Avail: NTIS HC A07/MF A01

In the earlier part of this review, it was pointed out that a diversity of coal characteristics was to be expected because of the existence of many different environments of deposition, the material contributions from many different floristic assemblages, and the widely differing temperature/time/pressure histories It is already clear that the coals found within the geographic area of the United States of America do indeed constitute a widely diverse set of materials. However, the findings discussed in the previous section strongly suggest that all present classification systems are inadequate, and that both the science and technology of coal urgently need a new classification that inevitably must be based on geology and geochemistry It is in distinguishing the geochemistry of various groups of coals that the analysis of soluble biological markers may be valuable Differences in the distribution of these molecules may be related to the character of environments of deposition and so provide important clues to the personalities of the insoluble matter in coals. B W

N83-22768# Department of Energy, Pittsburgh, Pa Energy Technology Center

CONVERSION OF COAL TO SYNTHETIC FUELS

B D. BLAUSTEIN In Univ of South Florida Workshop Rept on Basic Res in Org Geochem. Appl to Natl Energy Needs 11 p Jan 1982 refs

Avail: NTIS HC A07/MF A01

In 1979, almost one-half of U S energy supplies was from oil Our need for liquid fuels, together with our dependence on imported oil, has greatly increased interest in producing synthetic fuels from coal, of which we have large reserves This paper discusses the various routes available to produce synfuels from coal Author

04 FUELS AND OTHER SOURCES OF ENERGY

N83-22769# Pacific Gas and Electric Co., San Francisco, Calif.
DEVELOPMENT OF THE UTILIZATION OF COMBUSTIBLE GAS PRODUCED IN EXISTING SANITARY LANDFILLS: EFFECTS OF CORROSION AT THE MOUNTAIN VIEW, CALIFORNIA LANDFILL GAS-RECOVERY PLANT

Oct 1982 64 p refs
 (Contract DE-FG01-79CS-20291)
 (DE83-001576, DOE/CS-20291/3) Avail NTIS HC A04/MF A01

Corrosion of equipment has occurred at the Mountain View, California Landfill Gas Recovery Plant. Corrosion is most severe on compressor valve seats and cages, tubes in the first and second stages of the interstage gas cooler, and first and second stage piping and liquid separators. Corrosion occurs because the raw landfill gas contains water, carbon dioxide, and oxygen. Some corrosion may also result from trace concentrations of organic acids present in the landfill gas. Corrosion of the third stage compressor, cooler, and piping does not occur because the gas is dehydrated immediately prior to the third stage. Controlling corrosion is necessary to maintain the mechanical integrity of the plant and to keep the cost of the gas competitive with natural gas. Attempts to reduce corrosion rates by injecting a chemical inhibitor have proved only partially successful. Recommendations for dealing with corrosion include earlier dehydration of the gas, selection of special alloys in critical locations, chemical inhibition, and regular plant inspections. DOE

N83-22775# Los Alamos Scientific Lab., N. Mex.
RECOVERY OF GAS FROM HYDRATE DEPOSITS USING CONVENTIONAL PRODUCTION TECHNOLOGY

P L MCGUIRE 1982 8 p refs Presented at Unconventional Gas Recovery Symp., Pittsburg, Pa., 16 May 1982
 (Contract W-7405-ENG-36)
 (DE82-008106, LA-UR-82-518, CONF-820524-3) Avail NTIS HC A02/MF A01

Methane hydrate gas could be a sizeable energy resource if methods can be devised to produce this gas economically. This paper examines two methods of producing gas from hydrate deposits by the injection of hot water or steam, and also examines the feasibility of hydraulic fracturing and pressure reduction as a hydrate gas production technique. A hydraulic fracturing technique suitable for hydrate reservoirs is also described. DOE

N83-22781# California Univ., Berkeley Lawrence Berkeley Lab
 Solar Energy Program

METHODS FOR EVALUATING THE DOE APPROPRIATE-TECHNOLOGY PROGRAM: A REVIEW AND COMPILATION OF EVALUATION METHODS

B LUCARELLI Jul 1982 85 p refs
 (Contract DE-AC03-76SF-00098)
 (DE83-003306, LBL-14782) Avail NTIS HC A05/MF A01

Procedures for evaluating the energy impact of renewable energy resource projects funded by the appropriate technology (AT) program are described. A discussion of the various evaluation approaches used by LBL over the past 2 years, definitions of key concepts such as direct and indirect energy impact and cost effectiveness, and recommendations of a simplified evaluation approach for the future are included. Procedures for evaluating the direct energy impact from six renewable energy resource systems are (1) wind electric, (2) hydroelectric, (3) anaerobic digestion, (4) active solar water and space heating, (5) passive solar, and (6) geothermal space and water heating as well as weatherization. Economic concepts and simplified approach for computing the cost effectiveness of small energy projects are defined. DOE

N83-22789# Washington State Univ., Pullman. Geological Engineering Sect

LOW-TEMPERATURE GEOTHERMAL RESOURCE AND STRATIGRAPHY OF PORTIONS OF YAKIMA COUNTY, WASHINGTON M.S. Thesis

J BIGGANE 30 Jul 1982 146 p refs
 (Contract DE-AC07-79ET-27014)
 (DE83-001433, DOE/ET-27014/T2, WSU-82/15-7, WDGER-OP-82-6) Avail NTIS HC A07/MF A01

The low temperature geothermal resource of portions of Yakima County, south central Washington, is defined by several least squares linear regression analyses of bottom hole temperature and depth data. Bottom hole temperature and depth data were separated into fourteen well data groups based on geographic proximity, land slope azimuth, and position within the regional ground water flow system. The depths of these wells range from over 50m to almost 600m. The regression analyses of these well data groups indicate that the projected land surface temperature and geothermal gradient range from 10.6 to 14.00C and from 24.9 to 52.20C/km, respectively. Stratigraphic correlation diagrams developed from borehole geophysical and lithologic logs are given for localities within the lower Yakima, Black Rock, Moxee, Ahtanum, Cowiche, and Naches valleys. These correlation diagrams are combined with their respective borehole temperature logs and well data group predicted temperature curves to assess the validity of the regression analyses and to determine aquifer locations, temperatures, and directions of intra-borehole flow. DOE

N83-22790# Geological Survey, Lawrence, Kans.
ASSESSMENT OF THE GEOTHERMAL RESOURCES OF KANSAS Final Report

D W STEEPLES, ed and S A STAVNES, ed Jun 1982 83 p refs
 (Contract DE-AS07-79ET-27204, AT(49-24)-0256, DI-14-08-001-G-137)
 (DE83-003234, DOE/ET-27204/T1-VOL-1-SECT-1) Avail NTIS HC A05/MF A01

The following regional geological and geophysical studies are reported: establishment of a geothermal gradient data base from approximately 45,000 bottom hole temperatures recorded from well logs and interpretation of this data in terms of regional geology and establishment and interpretation of a second data base of geothermal gradients from thermal logging data from 144 holes of opportunity in the state. DOE

N83-22793# Colorado State Univ., Fort Collins
METHANOL PRODUCTION FROM FERMENTOR OFF-GASES Final Report, 1 Jul. 1981 - 30 Jun. 1982

B. E. DALE and A. R. MOREIRA 1982 22 p refs
 (Contract DE-FG07-81ID-12325)
 (DE83-005011, DOE/ID-12325/4) Avail NTIS HC A02/MF A01

The off gases from an acetone butanol fermentation facility are composed mainly of CO₂ and H₂. Such a gas stream is an ideal candidate as a feed to a methanol synthesis plant utilizing modern technology recently developed and known as the CDH-methanol process. A detailed economic analysis for the incremental cost of a methanol synthesis plant utilizing the off gases from an acetone butanol fermentation indicates a profitable rate of return of 25 to 30% under the most likely production conditions. Bench scale studies at different fermentor mixing rates indicate that the volume of gases released during the fermentation is a strong function of the agitation rate and point to a potential interaction between the volume of H₂ evolved and the levels of butanol present in the final fermented broth. Such interaction may require establishing optimum operating conditions for an integrated butanol fermentation methanol synthesis plant. DOE

04 FUELS AND OTHER SOURCES OF ENERGY

N83-22803# Hanford Engineering Development Lab., Richland, Wash.

ASSESSMENT OF THE NEED FOR DRY COOLING, 1981 UPDATE

J C SONNICHSEN Jan. 1982 117 p refs

(Contract DE-AC06-76FF-02170)

(DE82-009395; HEDL-TME-81-47) Avail NTIS HC A06/MF A01

An assessment of the need for dry cooling of steam-electric power plants over the time period 2000 to 2020 is documented. In the assessment three scenarios for future growth in electrical energy were examined. Characteristics of fresh water supply and consumptive use of water in each of the 99 aggregated subareas within the contiguous United States were reviewed, based on this review the need for dry cooling in each pertinent subarea was delineated DOE

N83-22807# Texas A&M Univ., College Station Center for Energy and Mineral Resources

ETHANOL PRODUCTION IN SMALL- TO MEDIUM-SIZE FACILITIES Final Report

E A HILER, C G COBLE, H. P. ONEAL, J M SWEETEN, V G REIDENBACH, G T SCHELLING, J T. LAWHON, R D. KAY, W A. LEPORI, W. H ALDRED et al Apr 1982 152 p refs

(Contract TENRAC PROJ. 80-B-1-1)

(DE83-900875; TENRAC/EDF-066) Avail. NTIS HC A08/MF A01

In early 1980 system design criteria were developed for a small-scale ethanol production plant. The plant was eventually installed on November 1, 1980. It has a production capacity of 30 liters per hour; this can be increased easily (if desired) to 60 liters per hour with additional fermentation tanks. Sixty-six test runs were conducted to date in the alcohol production facility. Feedstocks evaluated in these tests include: corn (28 runs), grain sorghum (33 runs); grain sorghum grits (1 run), half corn/half sorghum (1 run); and sugarcane juice (3 runs). In addition, a small bench-scale fermentation and distillation system was used to evaluate sugarcane and sweet sorghum feedstocks prior to their evaluation in the larger unit. In each of these tests, evaluation of the following items was conducted: preprocessing requirements; operational problems; conversion efficiency (for example, liters of alcohol produced per kilogram of feedstock), energy balance and efficiency, nutritional recovery from stillage; solids separation by screw press, chemical characterization of stillage including liquid and solids fractions; wastewater requirements; and air pollution potential DOE

N83-22812# Opportunity Systems, Inc., Washington, D.C

STATE OF CALIFORNIA: RESOURCE-RECOVERY PROFILE

DOE Jan 1983 206 p refs

(Contract DE-AC01-81CS-24454)

(DE83-004949; DOE/CS-24456/2) Avail NTIS HC A10/MF A01

The municipal refuse-to-energy conversion projects in the State of California are identified and outlined. Technologies include combustion systems, refuse-derived fuel systems, co-combustion, methane from landfill systems, and methane from wastewater systems. Also included is a brief legislative history and discussion of progress and problems relating to the waste-to-energy projects DOE

N83-22821# Pritchard Corp., Kansas City, Mo

UNDERGROUND COAL GASIFICATION (UCG) GAS TO METHANOL AND MTG-GASOLINE: AN ECONOMIC AND SENSITIVITY STUDY, TASK B

Jun. 1982 238 p refs

(Contract W-7405-ENG-48)

(DE83-004320; UCRL-15510) Avail. NTIS HC A11/MF A01

The technical and economic aspects of the production of methanol and gasoline using gas from an underground coal gasification (UCG) facility are discussed. The economics of producing gasoline is studied as well as a number of other aspects of the economics of upgrading UCG gas. Capital and operating costs for three different capacities of gasoline plants are presented

These are 1600 barrels per day (BPD), 4800 BPD, and 9600 BPD. These capacities are equivalent to fuel grade methanol plants having capacities of 4000 BPD, 12,000 BPD, and 24,000 BPD - the methanol capacities considered in the previous studies. The economics of the gasoline plant were developed using published information and the best estimate of the processing steps in the gasoline process. Several sensitivity studies were undertaken to examine the sensitivity of both methanol and gasoline product costs to changes in technical and economic parameters DOE

N83-22823# Exxon Research and Engineering Co., Bayton, Tex.

DYNAMIC SIMULATION OF EXXON'S CATALYTIC COAL-GASIFICATION PROCESS

H D FRANKLIN, R S PARNAS, C KAHN, and N Y GAITONDE Nov 1982 17 p refs Presented at the Ann

Meeting of Heat Transfer and Energy Conversion, Los Angeles, 14 Nov 1982

(Contract DE-AC01-78ET-13005)

(DE82-021973; CONF-821106-9) Avail NTIS HC A02/MF A01

A dynamic simulation of the Catalytic Coal Gasification (CCG) process was done to determine whether the process interactions presented any controllability problems as well as to help design a control scheme for the process. While there were previous dynamic simulation of both fixed and fluidized bed coal gasifiers, these simulations were all performed for noncatalytic gasification processes, and thus would not show the process dynamics implications resulting from the unique features of the CCG process. Unique features of closed control loop responses are given. The Exxon Catalytic Coal Gasification process is a novel method for producing methane directly from coal. Its key features from a process dynamics standpoint are use of a catalyst which causes both the highly endothermic gasification and exothermic methanation reactions to occur in the same reactor, separation of product gas in a highly heat-integrated cryogenic section, and recycle of product carbon monoxide and hydrogen back into the reactor. DOE

N83-22824# Department of Energy, Grand Forks, N. Dak. Energy Technology Center

LIQUEFACTION BEHAVIOR OF A CANADIAN SUBBITUMINOUS COAL IN COMPARISON WITH SEVERAL US LIGNITES AND SUBBITUMINOUS COALS

G. G BAKER, C. L. KNUDSON, S A FARNUM, B W FARNUM, and W G WILLSON Sep 1982 72 p refs

(DE82-021976; DOE/GFETC/RI-82/5) Avail NTIS HC A04/MF A01

A conceptual design is presented for a preparation facility processing 1.46 million tons per year (4000 tpd) of lignite in which the sodium content of the total product is reduced from 8.5 to 4 pct (as Na₂O in ash). Sodium removal from the lignite is by ion exchange using hydrogen ions from aqueous sulfuric acid. Limited experimental data was obtained using a bench scale continuous countercurrent ion exchange unit for design purposes. This includes the decision of the ion exchanger, the lignite washing and dewatering facilities, and the waste water clean-up steps. Complete material balances and energy requirements are presented. A brief discussion of instrumentation and process control is given. Most equipment can be obtained commercially. To limit the environmental impact, extensive cleaning and reuse of process water is employed. Waste effluent is discharged to an evaporation pond. The total capital investment was estimated to be \$21.88 million in mid-1979 dollars with annual operating costs of \$6.08 million. The unit processing cost was determined at \$4.17 per ton of lignite input. Raw materials represent 9 pct of the unit cost, whereas finance charges are nearly 32 pct. It was concluded that this ion exchange process is technically feasible, and in certain favorable circumstances, may be economically viable. Author

04 FUELS AND OTHER SOURCES OF ENERGY

N83-22825# Department of Energy, Morgantown, W Va Energy Technology Center

METHANE HYDRATES WORKSHOP TECHNICAL PROCEEDINGS

R D. MALONE, ed Aug 1982 123 p refs Workshop held at Morgantown, W Va, 29 Mar. 1982 (DE83-000580, DOE/METC-82/49, CONF-820393) Avail NTIS HC A06/MF A01

Included in the Methane Hydrates Workshop proceedings are three work group presentations, eight papers, four abstracts of papers and two appendices (workshop agenda and participation list) The eight papers are abstracted individually DOE

N83-22826# California Energy Commission, Sacramento. **GEOTHERMAL ENERGY, OPPORTUNITIES FOR CALIFORNIA BUSINESS. A TWO-DAY CONFERENCE ON DIRECT UTILIZATION OF GEOTHERMAL ENERGY**

Feb 1982 270 p refs Proc of Conf held in San Diego, Calif, 28-29 Sep 1981

(Contract DE-FC03-79ET-27135)

(DE82-012553, P-500-82-009, CONF-8109128) Avail NTIS HC A12/MF A01

Topics in geothermal energy utilization are discussed Opportunities for California business, financing of geothermal projects, sources of private investment, and reservoir insurance are among the topics discussed DOE

N83-22829# Process Plants, Inc., Houston, Tex **THE ENGINEERING AND ECONOMICS OF AN ETHANOL/GASOHOL JOINT-VENTURE PROJECT WITH CALDWELL SUGARS CO-OP, INC. AT THIBODAU, LOUISIANA. ATTACHMENT A. VOLUME 2: DEFINITION OF FACILITIES AND SCOPE OF WORK FOR AN ETHANOL FACILITY TO BE LOCATED AT THIBODAU, LOUISIANA**

Apr 1982 582 p 5 Vol

(Contract DE-FG07-81RA-50338)

(DE83-001165, DOE/RA-50338/1-VOL-2-ATTACH-A) Avail. NTIS HC A25/MF A01

Equipment specifications and the equipment specification index are presented for a plant capable of handling 10,000 bushels of grain per hour DOE

N83-22844# Northeastern Forest Experiment Station, Broomall, Pa

CONVERTING SMALL INDUSTRIAL BOILERS TO BURN WOOD FUELS Final Report

R L SARLES and J P RUTHERFOORD 1982 14 p

(PB83-128116, NSRP-NE-508, NEFES/83-11) Avail. NTIS HC A02/MF A01 CSCL 13B

The engineering and economic feasibility of retrofitting two small industrial boilers (32 hp and 52 hp, respectively) for firing green wood fuels is discussed Subjects covered include fuel requirements and costs, availability, storage, and handling of wood fuels, and designs, specifications, stack emissions, cost estimates, and economic feasibility The economics of boiler conversion projects are heavily dependent on annual savings in fuel costs. Analyses of variables affecting annual fuel savings determined that the boiler utilization rate and the price of fuel oil had the greatest impact on the economic feasibility of this project. Author (GRA)

N83-22845# Institute of Gas Technology, Chicago, Ill. **MULTI-FUEL LOW-NOX BURNER DEVELOPMENT, PHASE 2 Final Report, Mar. 1979 - Feb. 1982**

H A ABBASI, M J KHINKIS, and R T WAIBEL May 1982 236 p refs

(PB83-126292, GRI-82/0010) Avail NTIS HC A11/MF A01 CSCL 13B

The development of high efficiency, low nitrogen-oxides producing multi-fuel industrial burners with flame and heat transfer characteristics suitable for specific industrial processes was investigated Burners for three industrial processes were designed to achieve a reduction in NOx emissions compared with currently used standard burners: (1) a high excess air burner used in direct

air dryers for applications in the food processing industry, (2) a hot air burner with high convective heat transfer for direct fired metal processing furnaces, and (3) a hot air burner with a long, luminous flame for direct fired process furnaces in the steel, aluminum, and glass industries The high convective, hot air burner achieved NOx emission reduction of up to 50% NOx emissions from the hot air burner with a long, luminous flame were 45 to 60% lower than the standard burner GRA

N83-22896# CER Corp., Las Vegas, Nev.

A GEOLOGIC STUDY OF THE MICHIGAN BASIN Topical Report, Jul. 1981 - May 1982

R. E PETERSON May 1982 23 p refs

(PB83-136291, GRI-81/0025 5) Avail NTIS HC A02/MF A01 CSCL 08G

The Michigan Basin contains sediments from Cambrian through Pennsylvanian age The geologic basin is of greatest depth in Central Michigan with approximately 15,000 ft of strata To assess efficiently which formations have suitable reservoir characteristics to be included in the Gas Research Institute tight gas sands program, a catalog of the lower-permeability formations and their characteristics was required The lack of geologic units that were considered to have sufficient extent reservoir characteristics or gas reserves to be of interest as blanket-like gas sands precluded a more detailed inventory and characterization An overview of all gas productive formations in the Michigan Basin is given. GRA

N83-22903# CER Corp., Las Vegas, Nev

A GEOLOGIC STUDY OF THE RATON BASIN Topical Report, Jul. 1981 - Jul. 1982

J M GROMER Jul 1982 58 p refs

(PB83-136275, GRI-81/0025 2) Avail NTIS HC A04/MF A01 CSCL 08G

Within the Raton Basin, some Cretaceous sediments have been identified as containing blanket-like sands, i.e., the Trinidad and Dakota Sandstones, which are thick and widespread and contain natural gas reserves These reservoirs would probably require well stimulation and fracturing to make them economically feasible. In addition to identifying low-permeability, gas-bearing blanket-like formations, this report provides a compilation of industry activity and production within the study area In addition, it briefly reviews geological and operational information as an aid in evaluating the study area for future tight gas sands research The Raton Basin currently does not have commercial gas production although several gas shows have been encountered GRA

N83-22904# CER Corp., Las Vegas, Nev.

A GEOLOGIC STUDY OF THE BLACK WARRIOR BASIN Topical Report, Jul. 1981 - May 1982

R E PETERSON May 1982 36 p refs

(PB83-136283, GRI-81-0025 4) Avail NTIS HC A03/MF A01 CSCL 08G

The lower-permeability gas-bearing formations within the Black Warrior Basin are discussed To assess efficiently which formations have suitable reservoir characteristics to be included in the tight gas sands program, the lower-permeability formations were characterized The general basin geology was also summarized The characterized reservoir units include a summary of the regional geologic setting, hydrocarbon distribution and production, exploration activity and pipeline availability Within the study area, the Lower Mississippian Carter Sandstone may have sufficient extent, reservoir characteristics and gas reserves to be of interest to the tight gas sands program GRA

04 - FUELS AND OTHER SOURCES OF ENERGY

N83-22949# Virginia Inst of Marine Science, Gloucester Point
**EXAMINATION OF TIDAL FLATS. VOLUME 3: EVALUATION
 METHODOLOGY Final Report, Sep. 1977 - Sep. 1981**

R. J. DIAZ Washington Federal Highway Administration Jun
 1982 58 p refs 3 Vol
 (Contract DOT-FH-11-9360)
 (PB83-131805; SRAMSOE-256-VOL-3, FHWA/RD-80/183-VOL-3)
 Avail: NTIS HC A04/MF A01; also available in set of 3 reports
 HC E99 as PB83-131771 CSDL 08F

An approach to the evaluation of tidal flats is given which
 centers around state-of-the-art knowledge for assessing the values
 of tidal flats and establishing the basis for comparison of specific
 sites. Parameters identified as important for evaluation of tidal flat
 value fall into two categories; primary producers (chlorophyll a
 concentration and light intensity) and support populations (annelid,
 mollusc, and crustacean biomass and abundance). The information
 is of use in highway project planning GRA

N83-22960# Argonne National Lab., Ill
**TOXICOLOGY OF COAL GASIFICATION: CHEMICAL
 CHARACTERIZATION**

D. A HAUGEN, M. J PEAK, V C. STAMOUDIS, A S BOPARAI,
 C. A REILLY, JR., K E WILZBACH, K. M SUHRBIER, S S.
 DORNFIELD, D VENTERS, and F. J TREMMEL (Iowa Univ) /In
 ANL Biol and Med Res. p 65-68 Jun 1982 refs
 Avail NTIS HC A08/MF A01

The organic chemicals which are primarily responsible for the
 toxicological activity of synfuel materials, their mode of action and
 biological fate and their toxic activity when present in complex
 mixtures were investigated. The long range objectives are to provide
 information which is useful to: (1) establish chemical analysis and
 bioassays to predict toxic effects, and (2) direct possible alterations
 of process and cleanup conditions to decrease the potential for
 adverse health effects E A K

N83-23138# Los Alamos Scientific Lab., N. Mex
**THE LIGHT WEIGHT RADIOISOTOPE HEATER UNIT (LWRHU):
 A TECHNICAL DESCRIPTION OF THE REFERENCE DESIGN**

R. E. TATE Jan. 1982 39 p refs
 (Contract W-7405-ENG-36)
 (DE82-014121; LA-9078-MS) Avail. NTIS HC A03/MF A01

The Light Weight Radioisotope Heater Unit (LWRHU), a new
 radioisotope heater unit for use in space missions, is a 238
 PuO₂-fueled unit designed to provide a thermal watt in dispersed
 locations on a spacecraft The LWRHU is required to maintain
 the temperature of a component at a level where the component
 will function reliably in space Two major constraints are placed
 on the unit's design, it must be as light as possible and must
 provide enough protection to immobilize the plutonium fuel to the
 maximum extent in all phases of the unit's lifetime. The four
 components are pelletized fuel, platinum-alloy encapsulation,
 pyrolytic graphite thermal insulation, and high-technology graphite
 ablation shell. The LWRHU is a cylinder 32 mm (1.26 in) high
 and 26 mm (1.02 in) in diameter It weighs slightly less than 0
 g (09 lb) DOE

N83-23147# Los Alamos Scientific Lab., N. Mex
**REENTRY THERMAL TESTING OF LIGHT-WEIGHT
 RADIOISOTOPE HEATER UNIT**

D. E. PETERSON and J S STARZYNSKI Mar 1982 8 p
 refs
 (Contract W-7405-ENG-36)
 (DE82-014116, LA-9226) Avail NTIS HC A02/MF A01

Two Light-Weight Radioisotope Heater Units were exposed to
 thermal ramps simulating atmospheric reentry The helium release
 rates were measured during each test and modeled after simple
 diffusion theory The reentry pulses did not result in swelling of
 the claddings or degradation of fuel pellets. DOE

N83-23190# Oklahoma Univ., Norman. School of Chemical
 Engineering and Materials Science

**DEVELOPMENT OF A THERMODYNAMIC PROPERTIES
 CORRELATION FRAMEWORK FOR THE COAL CONVERSION
 INDUSTRY, PHASE 2 Semiannual Report, 1 Sep. 1981 - 28
 Feb. 1982**

K. E STARLING, L L. LEE, and K H KUMAR 1982 16 p
 refs

(Contract DE-FG22-80PC-30249)
 (DE82-009866; DOE/PC-30249/T3) Avail: NTIS HC A02/MF
 A01

A multiparameter corresponding states framework is being
 developed to predict the thermodynamic behavior of nonpolar,
 polar and associating coal fluids A three parameter corresponding
 states correlation was modified and applied to nonpolar and slightly
 polar pure, binary and multicomponent coal fluid systems
 Correlations were developed for obtaining the three corresponding
 states parameters for undefined mixtures Techniques for
 converting distillation analysis for undefined mixtures into
 pseudocomponents were also provided. Additional parameters were
 required for characterizing the behavior of highly polar and
 associating compounds found in liquefied coal An extension of
 the three parameters corresponding states correlation to a five
 parameter corresponding states correlation was made to predict
 the thermodynamic behavior of polar and associating pure coal
 fluids. DOE

N83-23213# Van Wyk and Louw, Inc., Pretoria (South Africa)

GASOLINE SHORTFALL MANAGEMENT

V PRINS /In CSIR Ann Transportation Conv., Vol. 2 23 p
 1982 refs

Avail NTIS HC A20/MF A01

Two aspects of a gasoline shortfall are emphasized: the options
 available to the government to deal with it and the requirements
 for a quantitative methodology to evaluate these options. To answer
 these questions the the US experience of shortfalls is sketched
 a conceptual framework from within which to view a shortfall is
 developed, and a methodology to evaluate different policy
 alternatives from an efficiency as well as an equity perspective is
 outlined S L

N83-23214# Council for Scientific and Industrial Research,
 Pretoria (South Africa)

ALTERNATIVE MOTOR FUELS

E. A UKEN (FEDHASA) /In its Ann Transportation Conv., Vol 2
 27 p 1982 refs

Avail NTIS HC A20/MF A01

South Africa has many options as far as alternative motor
 fuels are concerned These range from the existing SASOL synfuel
 from coal program, which will eventually satisfy 60 per cent of the
 transport needs, to methanol, ethanol and esterified plant oils
 The use of these alternatives in spark ignition and compression
 engines is considered, either as supplements or as total substitutes
 for oil products S L

N83-23215# Daimler-Benz A. G., Stuttgart (West Germany)
**PROSPECTS OF MOTOR VEHICLES AS A MEANS OF
 TRANSPORTATION AND OF ALTERNATIVE DRIVES**

C. F BADER /In CSIR Ann Transportation Conv., Vol 2 23 p
 1982

Avail: NTIS HC A20/MF A01

The predominance of motor vehicles as a means of transport
 is ascribable to the various advantages that such vehicles offer,
 including their use of liquid fuels, which makes them very versatile
 It is necessary to investigate to what extent crude oil can be
 replaced with alternative fuels or drives as the means of supplying
 energy to motor vehicles. Alternative drives may consist of an
 electric energy supply on its own, or may combine two different
 driving or energy-supplying units in the form of a hybrid drive
 system The various possible alternative drives for buses should
 meet the criteria of freedom of operational choice, independent of
 crude oil and use of primary energy to varying extents Except in
 the case of the trolley bus, freedom of operational choice and

increased independence of crude oil are always accompanied by increased use of primary energy, and usually by higher operating costs. The higher costs are partly a result of higher vehicle purchasing costs and partly a result of the additional infrastructure required for operation. Author

N83-23249# Southwest Research Inst., San Antonio, Tex
CHARACTERIZATION OF EXHAUST EMISSIONS FROM METHANOL- AND GASOLINE-FUELED AUTOMOBILES Final Report, Jun. 1981 - Mar. 1982

L R SMITH and C M URBAN Aug 1982 180 p refs
(Contract EPA-68-03-2884, EPA-68-03-3073)
(PB83-116830, EPA-460/3-82-004) Avail NTIS HC A09/MF A01 CSCL 13F

Regulated and unregulated exhaust emissions from four light duty, ignited automobiles were characterized. Two of the automobiles were evaluated with gasoline; one of these was also operated on a gasoline alcohol blend. The two other vehicles were evaluated with methanol fuel. The automobiles were evaluated over the Light-Duty Federal Test Procedure (FTP) and the Highway Fuel Economy Driving Schedule (HFET). Addition evaluations with the methanol fueled automobiles were conducted using promoted base metal catalysts, and the one was evaluated in a noncatalyst configuration. GRA

05

ENERGY CONVERSION

Includes thermomechanical, thermoelectric, geothermal, ocean thermal, and wind energy conversion. Also includes nuclear reactors, magnetohydrodynamic generators, and fuel cells.

A83-19876

THE STRUCTURE OF THE DOUBLE LAYER AT THE MERCURY-PHOSPHORIC ACID INTERFACE FROM STUDIES OF ADSORPTION OF THIOUREA AND ITS IMPLICATIONS ON OXYGEN REDUCTION KINETICS

E R GONZALEZ, K-L HSUEH, and S SRINIVASAN (Los Alamos National Laboratory, Los Alamos, NM) (Electrochemical Society, Meeting, Denver, CO, Oct. 11-16, 1981) Electrochemical Society, Journal, vol 130, Jan 1983, p 1-5. Research sponsored by the U.S. Department of Energy. refs

The results of double layer studies at the electrode-phosphoric acid interface of the phosphoric acid fuel cell conducted to elucidate the interface's effect on oxygen reduction kinetics are reported. Thiourea was utilized as the probe species, mercury was chosen as the electrode material, and the electrolyte was 95 percent phosphoric acid. Capacity curves for the control electrolyte, and for this electrolyte and nine concentrations of thiourea, were obtained, and the adsorption characteristics of thiourea were studied by finding the surface excess of thiourea as a function of the electrode charge density. The characteristics of the inner layer were explored by determining the potential drop across it as a function of the surface excess of thiourea, the electrode charge density as a function of the potential drop for zero surface excess, and the surface excess as a function of the bulk concentration of thiourea. The amount of thiourea adsorbed can be described by a Henry's law type of isotherm. C D

A83-19883

ELECTROPHORETICALLY DEPOSITED CDS AND CDSE ANODES FOR PHOTOELECTROCHEMICAL CELLS

Y. UENO, H MINOURA, T NISHIKAWA, and M. TSUIKI (Gifu University, Yanagido, Japan) Electrochemical Society, Journal, vol 130, Jan. 1983, p. 43-47. refs

The electrophoretic deposition of CdS, CdSe, and their mixtures has been studied for the preparation of thin film anodes for photoelectrochemical cells. These films were obtained in a homogeneous state on SnO₂-coated glass substrates from the

suspensions using polar organic dispersion media. Prior to photoelectrochemical experiments, the thin film anodes were thermally treated for 3 hr at 400-600 C. An energy conversion efficiency of 2% was observed for the photoelectrochemical cells using these film anodes in S(2-)/S(x)(2-) electrolytes. (Author)

A83-19884

MOLTEN CARBONATE FUEL CELL PERFORMANCE MODEL

T. L. WOLF and G WILEMSKI (Physical Sciences, Inc., Andover, MA) Electrochemical Society, Journal, vol 130, Jan. 1983, p 48-55 refs

(Contract DE-AC03-79ET-11322, W-31-109-ENG-38)

A two-dimensional numerical model is developed to simulate nonisothermal performance of molten carbonate fuel cells. The model takes account of gas stream utilization due to electrochemical reaction, conductive heat transfer between cell hardware and gas streams, energy transfer accompanying mass addition to the bulk streams, convective heat transfer by the bulk streams, and inplane heat conduction through the cell hardware. Individual porous electrode models are used to predict the local dependence of current density on cell temperature and gas composition. Calculated results are compared with experimental data for 94 square cm isothermal cells with crossflow geometry for various fuel and oxidant compositions, total gas pressures, and cell temperatures. Excellent agreement is obtained. Calculated distributions of current density and cell temperature are also presented for 1 square cm nonisothermal cells for cross-, co-, and counterflow geometries. Current density and cell temperature distributions are found to be highly coupled. Calculated temperature differences on the order of 200 K are observed across the face of a cell operating at maximum load. (Author)

A83-19891

SIMPLE POROUS ELECTRODE MODELS FOR MOLTEN CARBONATE FUEL CELLS

G WILEMSKI (Physical Sciences, Inc., Andover, MA) Electrochemical Society, Journal, vol. 130, Jan 1983, p 117-121. refs

(Contract DE-AC03-79ET-11322)

Individual porous electrode models for the anode and cathode of a molten carbonate fuel cell are described. These models are used to calculate local cell overpotential and current density in an integral cell model that predicts overall current density and voltage of scaled-up isothermal and nonisothermal cells. The analysis is based on the thin film cylindrical bore model and includes the effects of the finite electrolyte conductivity and diffusion of dissolved gas species in the electrolyte film. Transfer current density equations are used to evaluate parameters for physical properties, thin film and pore properties, and electrode kinetic parameters for anode and cathode. Comparison with experimental results shows that the partial pressure dependence is very well predicted for both electrodes. C.D.

A83-20576* National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio

CROSS-LINKED POLYVINYL ALCOHOL FILMS AS ALKALINE BATTERY SEPARATORS

D W SHEIBLEY, M A MANZO, and O. D. GONZALEZ-SANABRIA (NASA, Lewis Research Center, Cleveland, OH) Electrochemical Society, Journal, vol 130, Feb 1983, p 255-259. refs

(Contract NAS3-22223)

Cross-linking methods have been investigated to determine their effect on the performance of polyvinyl alcohol (PVA) films as alkaline battery separators. The following types of cross-linked PVA films are discussed: (1) PVA-dialdehyde blends post-treated with an acid or acid periodate solution (two-step method) and (2) PVA-dialdehyde blends cross-linked during film formation (drying) by using a reagent with both aldehyde and acid functionality (one-step method). Laboratory samples of each cross-linked type of film were prepared and evaluated in standard separator screening tests. Then pilot-plant batches of films were prepared and compared to measure differences due to the cross-linking method. The pilot-plant materials were then tested in nickel

05 ENERGY CONVERSION

oxide-zinc cells to compare the two methods with respect to performance characteristics and cycle life. Cell test results are compared with those from tests with Celgard. (Author)

A83-20590

THE EQUILIBRIUM CONSTANT FOR THE REVERSIBLE REACTION $\text{H}_2\text{S} + 3\text{H}_2\text{O} + \text{Li}_0.66\text{K}_0.34/2 \text{ CO}_3$ YIELDS $4\text{H}_2 + \text{CO}_2 + \text{Li}_0.66\text{K}_0.34/2 \text{ SO}_4$ AT ELEVATED TEMPERATURE
S. W. SMITH and S. M. KAPELNER (United Technologies Corp., Power Systems Div., South Windsor, CT) Electrochemical Society, Journal, vol. 130, Feb. 1983, p. 405-407. Research supported by the U.S. Department of Energy.

The equilibrium constant of the reversible reaction $\text{H}_2\text{S} + 3\text{H}_2\text{O} + (\text{Li}_0.66\text{K}_0.34)_2 \text{ CO}_3$ yields $4\text{H}_2 + \text{CO}_2 + (\text{Li}_0.66\text{K}_0.34)_2 \text{ SO}_4$ at elevated temperature and in an aqueous medium is investigated. The technique used consists of passing fuel gases containing H_2S over a thin layer of electrolyte and determining the composition of the electrolyte at equilibrium. The experimental material and set-up are described. The carbonate/sulfate ratio in the reacting system is measured at equilibrium at three temperatures, and the corresponding gas compositions are determined. From the data obtained, the equilibrium constant is determined. It is concluded on the basis of the results that the maximum sulfate concentration at equilibrium will not be sufficient to cause significant Nernst concentration potential loss. The results calculated from the free energy of formation for $(0.66\text{Li}_2\text{SO}_4 - 0.34\text{K}_2\text{SO}_4)$ are presented and the enthalpy change of the reaction can be calculated by plotting $\log K$ vs. $1/T$. This investigation is pertinent to the study of the influence of trace levels of H_2S in the fuel stream of a molten carbonate fuel cell on cell performance. M.I.I.

A83-20596

POROUS PEROVSKITE ELECTRODE AS MOLTEN CARBONATE CATHODE

K. SCOTT, M. P. KANG, and J. WINNICK (Georgia Institute of Technology, Atlanta, GA) Electrochemical Society, Journal, vol. 130, Feb. 1983, p. 527-529.

The study of porous perovskite for possible utilization as standard electrodes in molten carbonate fuel cells is presented. The chosen perovskite, partially sintered $\text{La}(0.8)\text{Sr}(0.2)\text{CoO}_3$ (001), was prepared by decomposing the metal acetates and oxidizing it in air. It was subsequently mixed with methylcellulose to obtain a mixture of about 95% perovskite by weight, cold-pressed at 10000 psia and sintered in air for 4 hours at 1150 C, to form a 1.5 mm thick disk conductive at 25 C and with good mechanical strength. Polarizations were run at 600 C with two cathode gas compositions on (001) and NiO (002) cathodes and the results are compared. It is concluded that at high current densities at higher gas flow rates the mass transfer effects become appreciable and the perovskite electrode is seen to be inferior to the (002) electrode, while at lower gas flow rates the mass transfer characteristics of both electrodes appear to be equivalent. It is noted that there exists a correspondence between the kinetic performance of (001) and (002). M.I.I.

A83-20802

WIND CHARACTERISTICS IN SOUTHERN WYOMING

B. E. MARTNER and J. D. MARWITZ (Wyoming University, Laramie, WY) Journal of Applied Meteorology, vol. 21, Dec. 1982, p. 1815-1827. Research supported by the U.S. Department of Energy and Battelle Memorial Institute, U.S. Department of Interior. refs (Contract DI-9-07-70-S0104)

Climatological analyses of the anemometer data gathered during a wind energy survey of the Medicine Bow, WY area are reported. The instrumentation was placed in flat open spaces with a 1 cm roughness length. Twenty-five measurement sites were monitored, most at 4 m, some at 4 and 12 m, and one at varying levels up to 107 m, the measurements covered 7 yr at some sites. Topographic effects assured an antitriptic flow, and a funnel formation in the terrain accelerates the low-level winds. Winds were found to be more intense in winter than in summer, although winds aloft experience a greater downward transport of momentum

due to insolation and consequent enhanced vertical mixing during the summer daytime. The annual variability of the winds speeds, e.g., 7.8 m/sec winter vs. 4.3 m/sec summer at one site, are noted to be well fitted for replenishing reservoirs in the winter when runoff is lowest, while lowered power output is acceptable in the summer, when snowmelt runoff has filled the hydroelectric reservoirs. M.S.K.

A83-22020

NUMERICAL DETERMINATION OF THE CONFIGURATION OF A ROTATING BLADE WITH CONSTANT STRESS

P. J. VERMEULEN and J. A. SNYMAN (Pretoria, University, Pretoria, Republic of South Africa) Wind Engineering, vol. 6, no. 4, 1982, p. 178-184. refs

The governing equations for a constant stress troposkien which is perfectly flexible and inextensible are developed to determine the mass distribution. The blade is discretized into equal length links with varying masses in order that the stresses remain constant. D'Alembert's principle is employed in concert with centrifugal forces to model the problem in a static configuration. The resulting model is asymmetric with respect to the individual links. Calculations are performed by means of the shooting method starting from the top link of the troposkien and ending at the bottom root, thus obtaining a biased mass distribution. Computing the inverse problem by starting from the bottom root eliminates the bias. It was found that a blade with constant stress will enclose a larger area than a normal blade, and will therefore capture wind energy more efficiently. M.S.K.

A83-22021

A WIND-DIESEL ENERGY SYSTEM FOR GRIMSEY, ICELAND

R. MAGNUSSON (State Electric Power Works, Reykjavik, Iceland) Wind Engineering, vol. 6, no. 4, 1982, p. 185-192.

The wind conditions and energy use on a northern, remote island are described. Possibilities for reduction of energy costs via utilization of wind energy and diesel-engine waste heat, along with conversion to heat production in a central plant, are discussed. A composite system for supplying both electrical and thermal energy is proposed. A preliminary analysis indicates that such a scheme can be economically feasible. (Author)

A83-22022

OPERATING CONSIDERATIONS IN RELIABILITY OF MODELLING OF WIND-ASSISTED UTILITY SYSTEMS

A. J. JANSSEN (Netherlands Energy Research Foundation ECN, Petten, Netherlands) Wind Engineering, vol. 6, no. 4, 1982, p. 193-205. refs

A83-22318

ISRAEL CONFERENCE ON MECHANICAL ENGINEERING, 16TH, TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY, HAIFA, ISRAEL, JULY 13, 14, 1982, PROCEEDINGS

Conference sponsored by the Technion - Israel Institute of Technology, University of Negev, Tel Aviv University, and Association of Engineers and Architects in Israel. Israel Journal of Technology, vol. 20, no. 1-2, 1982. 96 p.

The present conference on topics in mechanical engineering considers advances in high speed rolling element bearings, the dynamic analysis of mechanical concentrators and nonuniform elements through modulation functions, problems associated with carbon oxidation, influence coefficients for variable geometry free gas turbines, and the thermoelastohydrodynamic analysis of an oil pumping ring seal. Also discussed are the detailed analysis of the effects of inertia on the filtration efficiency of granular bed filters, the use of gas dynamics to improve reciprocating engine performance, the optimization of vehicle powertrain performance by means of simulations, and the laboratory modeling of in situ retorting by steam injection and cracking of shale oil liquids. O.C.

A83-22675

LOAD FOLLOWING IMPACTS OF A LARGE WIND FARM ON AN INTERCONNECTED ELECTRIC UTILITY SYSTEM

E J. SIMBURGER and C K. CRETCHER (Aerospace Corp., Energy and Resources Div., Los Angeles, CA) (Institute of Electrical and Electronics Engineers, Summer Meeting, San Francisco, CA, July 18-23, 1982.) IEEE Transactions on Power Apparatus and Systems, vol PAS-102, Mar 1983, p. 687-692 refs

A major issue encountered in the use of many of the renewable energy resources for the production of electric power is the variability of the resource itself. This paper presents the results of a dynamic simulation of the long term power system responses to changes in the load and generation patterns resulting from significant penetrations of renewable resource technologies. The renewable technology selected for this study is a large wind farm with a total output of 500 MW added to the 1979 generation base of the Los Angeles Department of Water and Power system (Author)

A83-23126#

ANALYTICAL INVESTIGATION OF AXIAL FIELD LIMITATIONS IN MHD GENERATORS

W. UNKEL and C H KRUGER (Stanford University, Stanford, CA) Journal of Energy, vol 7, Mar-Apr 1983, p 97, 98 refs
(Previously announced in STAR as N82-24981)

A83-23128#

AERODYNAMIC TESTS OF DARRIEUS WIND TURBINE BLADES

P. G. MIGLIORE (California, University, Davis, CA), W P WOLFE (Sandia National Laboratory, Albuquerque, NM), and R E WALTERS (West Virginia University, Morgantown, WV) (Wind Energy Conference, Boulder, CO, April 9-11, 1980, Technical Papers, p 227-237). Journal of Energy, vol 7, Mar-Apr. 1983, p. 101-106 NSF-sponsored research refs
(Contract EY-76-C-05-5135)

(Previously cited in issue 10, p. 1845, Accession no A80-28832)

A83-23130#

CROSS-SECTIONAL CURRENT DISTRIBUTION IN COAL FIRED DIAGONAL CONDUCTING WALL MHD GENERATOR

A R KUMARAN, B. L. LIU, and Y. C. L. WU (Tennessee, University, Tullahoma, TN) Journal of Energy, vol. 7, Mar-Apr 1983, p 112-117 refs
(Contract DE-AC02-79ET-10815)

(Previously cited in issue 17, p 3011, Accession no A81-38092)

A83-23131#

MHD CHANNEL ELECTRICAL BOUNDARY-LAYER THEORY AND APPLICATIONS

S A ZWICK, E D DOSS, Y. C. PAN (Argonne National Laboratory, Argonne, IL), and S E SHAMMA (Argonne National Laboratory, Argonne, IL; West Florida, University, Pensacola, FL) Journal of Energy, vol 7, Mar-Apr 1983, p 118-127 Research supported by the U.S. Department of Energy refs

(Previously cited in issue 17, p 3011, Accession no A81-38094)

A83-23134*# Avco-Everett Research Lab., Mass

MHD CHANNEL PERFORMANCE FOR POTENTIAL EARLY COMMERCIAL MHD POWER PLANTS

D W SWALLOW (Avco Everett Research Laboratory, Inc., Everett, MA) (Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, Aug 9-14, 1981) Journal of Energy, vol 7, Mar-Apr 1983, p 141-146 refs
(Contract DEN3-51)

(Previously cited in issue 07, p. 1124, Accession no. A82-20750)

A83-23135#

CHARACTERISTICS OF A CLOSED BRAYTON CYCLE PISTON ENGINE

R J ROSA (Montana State University, Bozeman, MT) Journal of Energy, vol 7, Mar-Apr. 1983, p 147-151 refs

A closed Brayton cycle piston engine could use any high- or low-grade fuel, including unprocessed biomass or coal. Potential applications include small stationary power plants, and engines for vehicles. As a step toward assessing the feasibility of such an engine, calculations are described which allow one to compare the closed Brayton engine to an internal combustion (I.C.) piston engine with regard to efficiency, power per unit displacement, peak cylinder pressure, and coolant loading. As part of the calculations, mechanical efficiency, valve losses, and optimum pressure ratio are determined using methods developed for I.C. engines. It is shown that efficiency and power density are comparable to those of an I.C. engine, while pressure and coolant load are well within the range encountered in an I.C. engine (Author)

A83-23139#

MEASUREMENT OF PLASMA CONDUCTIVITY USING FARADAY ROTATION OF SUBMILLIMETER WAVES

P J KUZMENKO and S A SELF (Stanford, University, Stanford, CA) Journal of Energy, vol 7, Mar-Apr 1983, p. 176-181. NSF-supported research. refs

(Previously cited in issue 07, p 1122, Accession no. A82-19800)

A83-23171

APPLICATION OF MULTIVARIABLE SYSTEMS THEORY; SYMPOSIUM, PLYMOUTH, ENGLAND, OCTOBER 26-28, 1982, COLLECTED PAPERS

Symposium sponsored by the Institute of Measurement and Control, Institute of Marine Engineers, Institution of Chemical Engineers, et al London, Institute of Measurement and Control, 1982 230 p.

Topics discussed include the control systems design for uncertain dynamical systems, a time domain interaction measure for a multivariable plant, the recursive identification of multivariable state space models, a multivariable approach to the automatic pilotage of large ships in confined waters, and a multivariable controller for the depth control of a submersible vehicle. Also examined are the adaptive multivariable control of a naval propulsion plant, the multivariable identification and control of electric power plants, multivariable systems in a nuclear power plant, the design of an integrated control system for a supersonic aircraft power plant, dynamic models and state-linear filtering schemes for pH-processes, and the multivariable control of a metallurgical heat treating furnace N.B.

A83-24194#

ADVANCES IN WIND ENERGY TECHNOLOGY [FORTSCHRITTE IN DER WINDENERGIETECHNIK]

F. X. WORTMANN (Stuttgart, Universitaet, Stuttgart, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct 5-7, 1982, 11 p. In German. Research supported by the Bundesministerium fuer Forschung und Technologie refs
(DGLR PAPER 82-082)

Difficulties concerning the utilization of wind energy are examined. Such difficulties are partly related to the exposure of wind turbines to environmental conditions with wide fluctuations in the intensity of the wind, and to operational life requirements which exceed greatly those for an automobile. The employment of large rotating structures and requirements for competitive energy costs cause additional problems. The present investigation is concerned with an unusual approach for solving the problems involved in the utilization of wind energy, taking into account studies conducted since 1977. Three typical rotor configurations which are aerodynamically equivalent are considered. The first two configurations are found to have certain drawbacks. The third configuration, involving a one-blade rotor, is free of these disadvantages. One of the advantages of the one-blade rotor is its simple design. Objections usually raised against one-blade rotors

05 ENERGY CONVERSION

are investigated. It is found that the causes for these objections can be eliminated G R

A83-24195#

PROBLEM SOLUTION AREAS RELATED TO THE IMPLEMENTATION OF THE LARGE WIND TURBINE VOITH WEC 520 [PROBLEMIÖESUNGSBEREICHE BEI DER VERWIRKLICHUNG DER GROSSEN WINDTURBINE VOITH WEC 520]

W WEBER (Aalen, Fachhochschule, Aalen, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct 5-7, 1982, 11 p. In German (DGLR PAPER 82-083)

The large wind turbines currently being built or tested consist of a number of structural component groups. Modern aerospace technologies have been utilized in the design of certain wind turbine components. Aspects of rotor design are considered, taking into account approaches for optimizing the utilization of the wind energy, manufacturing problems related to the implementation of rotor blade designs with very favorable aerodynamical characteristics, and the utilization of new technology involving the employment of fiber composites. One decisive factor in favor of a selection of fiber composites for rotor blade construction is related to the requirements for a controlled modification of stiffness characteristics. G.R.

A83-24196#

STABILITY AND RESPONSE CHARACTERISTICS OF ONE- AND TWO-BLADE WIND TURBINES [STABILITAET UND ANTWORTVERHALTEN EIN- UND ZWEIBLAETTRIGER WINDTURBINEN]

E STEINHARDT and S WAGNER (Muenchen, Hochschule der Bundeswehr, Neubiberg, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct 5-7, 1982, 23 p. In German. refs (DGLR PAPER 82-084)

A83-24202#

ELECTRICITY FROM WIND - A SURVEY OF THE STATE OF THE ART AND FUTURE PROSPECTS FOR RESEARCH AND DEVELOPMENT [STROM AUS WIND - EIN UEBERBLICK UEBER DEN STAND UND DIE AUSSICHTEN VON FORSCHUNG UND ENTWICKLUNG]

R. WINDHEIM (Kernforschungsanlage Juelich GmbH, Juelich, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 25 p. In German. refs (DGLR PAPER 82-081)

Small, medium-size, and large wind power installations are surveyed. Projects in the first two of these size ranges, from about 10 kW up to 270 kW, are summarized. For large installations, the meteorological situations, the development and construction, the progress in research and technology, and the integration and storage of wind energy in the network are examined. The Growian and Monopteros projects are emphasized, giving relevant data and structural descriptions of both projects. Future projects are covered in some detail, and international activities are summarized. C D

A83-24721* General Electric Co., Schenectady, N. Y.

CONTROL DESIGN FOR A WIND TURBINE-GENERATOR USING OUTPUT FEEDBACK

S. H. JAVID, A. MURDOCH, and J. R. WINKELMAN (General Electric Co., Schenectady, NY) In Conference on Decision and Control, 20th, and Symposium on Adaptive Processes, San Diego, CA, December 16-18, 1981, Proceedings. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1981, p. 451-457. Research supported by the U.S. Department of Energy. refs (Contract DEN3-153)

The modeling and approach to control design for a large horizontal axis wind turbine (WT) generator are presented. The control design is based on a suboptimal output regulator which allows coordinated control of WT blade pitch angle and field voltage

for the purposes of regulating electrical power and terminal voltage. Results of detailed non-linear simulation tests of this controller are shown (Author)

A83-25125

OCEAN THERMAL-ENERGY CONVERSION

G. FORD, C. NIBLETT, and L. WALKER (Manchester, Victoria University, Manchester, England) IEE Proceedings, Part A - Physical Science, Measurement and Instrumentation, Management and Education, Reviews, vol 130, pt. A, no 2, Mar 1983, p. 93-100. Research supported by the Science and Engineering Research Council. refs

The principles underlying ocean thermal-energy conversion (OTEC) are reviewed, and a schematic layout of a system is included. The two systems currently under study, the open system and the closed system, are described. The prospect now, it is noted, is that OTEC plants will not be commercially viable on a widespread basis, even in the tropics. This is especially true of the large-scale plants that have been envisioned. A strong possibility is seen, however, that smaller plants, generating about 40 megawatts of electrical power, can survive commercially. The following conditions would favor their success: placement on land rather than at sea; placement in areas (such as islands) where alternative energy supplies are at a premium, and designing the plant to operate in conjunction with either an aquaculture or a desalination plant. C R

A83-25140

ROTARY ENGINES

W. J. TUCK. Aerospace (UK), vol 10, Mar 1983, p. 12-19.

A development history is presented for a variety of rotary operation aircraft engines, including the ancient aeolipile and contemporary Wankel engines, with emphasis on the air-cooled rotating cylinder designs employed in automobiles, and especially in aircraft, over the period from about 1900 to 1916. Of particular importance during the early phases of World War I was the Gnome engine invented by Louis and Laurent Seguin. The rapid replacement of engines of this type by designs with stationary cylinders is due to the large mechanical stresses generated by centrifugal force during operation, and to the aircraft-destabilizing gyroscopic forces generated by rotary engines of increasing power and weight. Their fuel and oil consumption were also considerably higher than those of stationary cylinder designs. O C

A83-25270*# Acurex Corp., Mountain View, Calif

CATALYST DURABILITY EVALUATION FOR ADVANCED GAS TURBINE ENGINES

G. C. SNOW and S. L. PESSAGNO (Acurex Corp., Energy and Environmental Div., Mountain View, CA) American Society of Mechanical Engineers, Joint Power Generation Conference, Denver, CO, Oct 17-21, 1982, 7 p. Research supported by the Acurex Corp.; U.S. Environmental Protection Agency. refs (Contract EPA-68-02-3122, DEN3-83) (ASME PAPER 82-JPGC-GT-21)

Catalytic combustion has demonstrated the ability to provide low NO(x) emissions while maintaining high combustion efficiency. Recently, under joint NASA Lewis, EPA, and Acurex sponsorship, a catalytic reactor was tested for 1000 hours to demonstrate durability in combustion environments representative of advanced automotive gas turbine engines. At a 740K air preheat temperature and a propane fuel/air ratio of 0.028 by mass, the adiabatic flame temperature was held at about 1700K. The graded cell monolithic reactor measured 5 cm in diameter by 10.2 cm in length and was operated at a reference velocity of 13.4 m/s at 1 atmosphere pressure. Measured NO(x) levels remained below 5 ppm while unburned hydrocarbon concentrations registered near zero and carbon monoxide levels were nominally below 20 ppm. The durability test included several parametric turndown studies and ended with a series of on/off cycling tests to further characterize reactor performance (Author)

A83-25538**COATING APPLICATIONS FOR THE MOLTEN CARBONATE FUEL CELL**

A PIGEAUD, A J SKOK, P S PATEL, and H C MARU (Energy Research Corp., Danbury, CT) In Metallurgical coatings 1981; Proceedings of the Eighth International Conference, San Francisco, CA, April 6-10, 1981 Volume 1 Lausanne, Elsevier Sequoia, S A, 1981, p 449-454
(Contract DE-AC03-76ET-11304)

The molten carbonate fuel cell is a highly efficient low polluting fuel-to-electricity conversion device which is at present being developed for power plant and industrial use. Because the alkali carbonates at the operating temperature of 650 C are corrosive and the methods employed for sealing the cell lead to certain electrochemical corrosion couples, different types of protective coatings are needed to minimize attack in a cost-effective manner. Besides protective purposes, other opportunities are also described where coating technology can be gainfully employed in this system (Author)

A83-25688#**SIZE EFFECTS IN DAWT INNOVATIVE WIND ENERGY SYSTEM DESIGN**

K M FOREMAN (Grumman Aerospace Research and Development Center, Bethpage, NY) American Society of Mechanical Engineers, Winter Annual Meeting, Phoenix, AZ, Nov. 14-19, 1982 11 p refs
(Contract XH-9-8073-1)
(ASME PAPER 82-WA/SOL-20)

The effect of size on the estimated weight and cost of an advanced wind energy conversion system, the diffuser-augmented wind turbine (DAWT), is investigated. Preliminary designs are developed for three DAWT sizes (ratings) in each of three construction types: all-aluminum, ferrocement, and a hybrid fiberglass reinforced plastic diffuser shell on an aluminum frame. Common design criteria are utilized for the designs employing these three materials, and the installed cost estimates are obtained from professional industrial estimators. Results show that for geometrically similar DAWTs the weight to power ratio varies approximately as the rotor diameter to the 1/3rd power, a 4 to 1 change in rotor diameter (27 m to 11 m). It is concluded that for DAWT unit ratings between 5 and 200 kW, the larger units appear increasingly to become more efficient structures with apparently lower specific costs for each of these constructions approaches.

N B

A83-26052**A ZINC PASTE PRIMARY BATTERY**

R JASINSKI, R MCCARRON, and G. BRILMYER (Occidental Research Corp., Irvine, CA) Electrochemical Society, Journal, vol 130, Mar 1983, p 539-542

It is pointed out that zinc/air batteries could, in principle, be used to power electric vehicles. One concept for enhancing the practical performance of this battery system involves the separation of energy density factors from power density factors. This concept can be implemented by employing the active negative plate material in the form of a zinc slurry, which is circulated from a reservoir through the negative electrode compartment. An extension of this fuel cell-battery concept is related to the utilization of the active material as a pumpable paste rather than as a slurry. The present investigation is concerned with preliminary experiments on formulating and characterizing pumpable zinc/zinc oxide pastes in the context of a primary zinc/oxygen battery. A 'paste' is defined as a thick viscous mass of solid, uniformly and semipermanently dispersed in a liquid phase. Attention is given to the physical basis for predicting which solid/liquid mixtures will provide pumpable pastes.

G R

A83-27126**IECEC '82; PROCEEDINGS OF THE SEVENTEENTH INTERSOCIETY ENERGY CONVERSION ENGINEERING CONFERENCE, LOS ANGELES, CA, AUGUST 8-12, 1982. VOLUMES 1, 2, 3, 4 & 5**

Conference sponsored by IEEE, ACS, AIChE, AIAA, ANS, ASME, and SAE. New York, Institute of Electrical and Electronics Engineers, 1982. Vol 1, 534 p, vol 2, 639 p, vol 3, 565 p, vol 4, 499 p, vol 5, 502 p

A comprehensive assessment of advanced energy conversion technologies is presented, including experimental, conventional, and developmental systems, and systems entering into wide-scale use. Attention is given to pyroelectric, gas-cooled nuclear reactor, and delta-wing ventilator concepts, and to space power systems. Biomass conversion technologies are examined, as are progress on electric vehicles, improvements in energy use efficiency, and evolving energy policy. Electrochemical and fossil fuel systems are studied, and geothermal energy, hydrogen fuels, and MHD systems are discussed. Consideration is directed toward nuclear, ocean thermal, and wave energy devices. The state of the art in Stirling engines, solar electric and thermal energy conversion systems, and thermionics is explored. Finally, consideration is given to thermal/wind energy storage and electrical and mechanical energy producing wind-powered machines.

D H K.

A83-27150**DISTRIBUTION VOLTAGE FOR HIGH-POWER SATELLITES**

C SOLLO (TRW, Inc., TRW Space and Technology Group, Redondo Beach, CA) In IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p 181-186 refs

Present satellites and spacecraft are designed predominantly with the nominal 28-volt electrical power system derived initially from aircraft experience and components. For future spacecraft with higher power requirements, a new voltage standard is required. Factors regarding the selection of a higher voltage are considered, taking into account requirements, constraints, and suitable voltage levels. The recommendation of 270 volts as a new power system standard for multikilowatt satellites is based upon a qualitative economic balance between the potential cost reduction of power equipment and the projected increase in development costs and technical risks as voltage levels increase.

G.R

A83-27157#**SPACECRAFT POWER TECHNOLOGY**

R R. BARTHELEMY and R. HONNEYWELL (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p. 226-229

During the last few years, a number of military space mission studies have provided new information regarding the future needs and directions of military spacecraft power systems. The power systems for these spacecraft must be hardened and/or survivable to a variety of potential threats. Future space operations may require autonomous operation from space, hence the power systems must become autonomous (self-monitoring and self-correcting). Performance (weight and volume, degradation, and life) of the power system remains a key system design issue. A new and important technology challenge is related to required scale up to higher powers.

G R.

05 ENERGY CONVERSION

A83-27161

AN ADVANCED ELECTRIC VEHICLE POWERTRAIN

B BATES and J. C. LESLIE (Ford Motor Co., Dearborn, MI) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p 296-300

In April 1982, a contract was awarded to an American automobile manufacturer to conduct research to develop and evaluate an advanced integrated alternating current powertrain technology. The concept 'powertrain' incorporates an ac induction motor and multispeed automatic transaxle contained in the same housing and operating on a common axis, a transistorized dc to ac inverter with inverter/motor controls and a microprocessor-based vehicle controller. The overall objective of the program is to demonstrate the feasibility of the advanced electric vehicle powertrain to meet design specifications and goals in an Escort or equivalent-sized vehicle. The performance goals include 0-50 mph acceleration in less than 20 seconds, the ability to climb a 30% grade, and a top speed of 60 mph. G.R.

A83-27162

ASSESSMENT OF PHOSPHORIC ACID AND TRIFLUOREMETHANE SULFONIC ACID FUEL CELLS FOR VEHICULAR POWERPLANTS

D. N. PATEL, A. LEO, L. TOBIAS, and P. VOYENTZIE (Energy Research Corp., Danbury, CT) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p 301-307. Research supported by the Los Alamos National Laboratory.

The use of fuel cells for transportation applications appears to be attractive for a number of reasons. These reasons are related to good fuel economy, long range, silent operation, environmental factors, the modular nature of fuel cells, and operation on nonpetroleum fuels. A study was conducted concerning the feasibility to employ fuel cells for passenger car applications. Two types of fuel cells were considered, including the phosphoric acid fuel cell (PAFC) and the trifluoromethane sulfonic acid fuel cell (TFMSAFC). The PAFC technology is well advanced and close to commercialization for utility application. An attractive feature of the TFMSAFC is the possibility of eliminating the noble metal catalyst. An investigation shows that both the PAFC and the TFMSAFC powerplants show great potential for mid-size passenger car applications. The efficiency of the powerplants, ranging from 44-50 mpg of gasoline equivalent, is much higher than that of the internal combustion engine. G.R.

A83-27180

ABUSE RESISTANT HIGH RATE LITHIUM/THIONYL CHLORIDE CELLS

J. SURPRENANT and D. SNUGGERUD (Altus Corp., San Jose, CA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 2. New York, Institute of Electrical and Electronics Engineers, 1982, p 635-637.

A compact, disk shaped lithium/thionyl chloride cell has been developed. The cell has a 6 Amphr capacity and is capable of high rate discharge at high voltage. Discharge data are presented over the range of 0.07 to 1.1 amperes. The cell is operable over the temperature range of -40 C to +70 C, and has a 10 year shelf life at 20 C. Safety features allow the cells to withstand fire, puncture, shock, spin, forced discharge or forced charge without dangerous reactions. (Author)

A83-27185

ACID FUEL CELL TECHNOLOGIES FOR VEHICULAR POWER PLANTS

D. K. LYNN, J. B. MCCORMICK, R. E. BOBBETT, J. R. HUFF, and S. SRINIVASAN (Los Alamos National Laboratory, Los Alamos, NM) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 2. New York, Institute of Electrical and Electronics Engineers, 1982, p 663-666. refs.

Three fuel cell technologies were assessed specifically for application as vehicular power plants. The considered cells include the phosphoric acid fuel cell (PAFC), the trifluoromethanesulfonic acid (TFMSA) fuel cell, and the solid polymer electrolyte (SPE) fuel cell. The results of the assessments were used to calculate the performance of a consumer vehicle with a number of different fuel cell power plants. It was found that the near-term PAFC system can power the base-line vehicle with reasonable acceleration, a range of over 400 miles on 20 gallons of methanol, and a 92% improvement in energy efficiency over the gasoline internal combustion engine (ICE) version. An SPE fuel cell system provides substantially improved performance and range with a 149% higher energy efficiency than the ICE-powered version. The advanced vehicle (ETV-1) with an SPE system provides performance competitive with today's gasoline ICE-powered vehicles and a gasoline energy equivalent of 66 mpg. G.R.

A83-27186

STATUS OF SOLID POLYMER ELECTROLYTE FUEL CELL TECHNOLOGY AND POTENTIAL FOR TRANSPORTATION APPLICATIONS

J. F. MCELROY and L. J. NUTTALL (General Electric Co., Wilmington, MA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 2. New York, Institute of Electrical and Electronics Engineers, 1982, p 667-671.

The solid polymer electrolyte (SPE) fuel cell represents the first fuel cell technology known to be used operationally. Current activities are mainly related to the development of a space regenerative fuel cell system for energy storage on board space stations, or other large orbiting vehicles and platforms. During 1981, a study was performed to determine the feasibility of using SPE fuel cells for automotive or other vehicular applications, using methanol as the fuel. The results of this study were very encouraging. Details concerning a conceptual automotive fuel cell power plant study are discussed, taking into account also a layout of major components for compact passenger car installation. G.R.

A83-27201*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.

PORE SIZE ENGINEERING APPLIED TO STARVED ELECTROCHEMICAL CELLS AND BATTERIES

K. M. ABBEY and L. H. THALLER (NASA, Lewis Research Center, Cleveland, OH) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 2. New York, Institute of Electrical and Electronics Engineers, 1982, p 757-764. refs. (Previously announced in STAR as N83-10134)

A83-27208

A CONCEPT OF HEAT PIPE ENGINE

Y. KOBAYASHI (Tsukuba, University, Sakura, Ibaraki, Japan) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p 1128-1133.

A closed thermal cycle heat pipe engine is described. The device capitalizes on inefficiencies in normal heat pipes such as small latent heat and a large variation of the saturated vapor pressure with temperature changes. Operations are at medium temperature and with two-phase liquid-vapor conditions. The engine body is kept in an adiabatic state, while the pressure vessel is in a thermosyphon configuration. A piston is included in the engine,

while the pressure vessel features an upper condenser thermal-conductively decoupled from a lower evaporator. The evaporator produces high pressure vapor, from which the condenser extracts heat flux in order to condense the vapor. A shutter exposes or shuts off the vapor from the condenser as needed. The vapor moves the piston before being condensed. A working model with methanol fluid and no piston has demonstrated the feasibility of the design, and plans for constructing a prototype engine working at near-300 C temperature are indicated. M S K

A83-27212

THE EFFECT OF PARASITIC REFRIGERATION ON THE EFFICIENCY OF MAGNETIC LIQUEFIERS

J A BARCLAY and W F STEWART (Los Alamos National Laboratory, Los Alamos, NM) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1166-1171 refs

Efficiency losses incurred by the operation of a small magnetic refrigerator stage to maintain cryogenic temperatures from the primary cold temperature to 4.2 K in a magnetic gas liquefier are calculated. The primary refrigeration is supplied by a helium cooled superconducting magnet, which does not require a continued current input once the field is established. The efficiency is modeled as the ratio of the real performance coefficient to the ideal coefficient, and is formulated by adding a term for irreversible entropy production to the second law of thermodynamics to make it an equality. A low limit is obtained for the size of magnetic liquefiers, e.g., 1 W at 4.2 K and 1 kW at 280 K. The necessity of providing adequate insulation against radiation and structural support heat leaks is emphasized. M S K

A83-27221

NUCLEAR REACTORS USING FINE PARTICULATE FUEL FOR PRIMARY POWER IN SPACE

T E BOTTS, J R. POWELL, J L USHER, and F L HORN (Brookhaven National Laboratory, Upton, NY) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1403-1408 refs

Design, safety, and operational features of two multi-MW nuclear reactor concepts for space use are reviewed. The rotating bed reactor (RBR) has a rotating core filled with a fluidized bed of UC/Zr coated particles held in place by centrifugal force and externally moderated. Coolant gas is piped in through a porous metal frit. The fixed bed design (FBR) features fuel held by an inner porous frit. Both reactors are projected to have fuel burns exceeding 50%, and coupling with a Brayton cycle engine is configured for electricity production, unless an MHD system is used, wherein He would be the working fluid. The reactors offer power densities of a GWt/cu m of fuel, good fatigue and thermal shock resistance, and cold state to full power within seconds. The fuel and reactor would be launched separately on Shuttle flights for safety, then boosted into higher orbits for powering a space station or for serving as a power supply for beaming energy to earth. M.S.K.

A83-27222* Jet Propulsion Lab., California Inst of Tech., Pasadena.

THERMOELECTRIC CONVERSION FOR SPACE NUCLEAR POWER

R EWELL and G STAPPER (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1409-1415 refs

A lightweight, high performance nuclear reactor power system can offer significant advantages for many space missions. Conceptual design has been completed for the SP-100, a system which utilizes many thermoelectric converters and is capable of

delivering 100 kilowatts of electrical power. A reference design, using thermoelectric materials with an average figure of merit of 0.001/K and a reactor heat pipe temperature of 1500 K, is presented which has a mass of 2280 kg not including contingency. The sensitivity of system mass to changes in the configuration and thermoelectric material properties are presented. (Author)

A83-27223

MARINE POWER - ACCOMPLISHMENTS OF THE 1970S

W R SCHMITT (California, University, La Jolla, CA) In IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1418-1421 refs

Progress made in the 1970s toward power production using marine power systems is discussed, noting that all renewable systems have a low intensity source. Consideration has been given to tidal, ocean current, kelp biomass, wave, salinity gradient, thermal gradient, and wind energy systems. Tidal plants delivering 240 MWe and 400 kWe are operating in France and Russia, respectively, and China is operating 90 small plants generating around 7 MW. Kelp growth rates were found to be lower than necessary for economic methane conversion. Experimentation in compressed air wave energy conversion is being pursued in Japan, and small programs are being conducted to study salinity gradients in the U.S. and Sweden. A 10 kW OTEC plant was operated successfully in Hawaii and the Japanese are testing a 100 kW plant. Offshore windpower is projected as the most likely marine system to succeed, both as a power producer and as a supplemental power system for ships. Near term efforts are expected to be in small facilities to expand the data base, gain experience in construction and operations, and to make evaluations. M S K

A83-27224#

SOME OCEAN ENGINEERING CONSIDERATIONS IN THE DESIGN OF OTEC PLANTS

T MCGUINNESS (NOAA, Rockville, MD) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1422-1426

Marine engineering problems associated with commercial OTEC systems are discussed. The major challenges reside in the low thermal efficiency, 3%, biofouling protection, and the size of the cold water pipe. A 400 MWe plant needs to be as large as a supertanker, in addition to needing a 100 ft diameter cold water pipe 300 ft long. It would discharge a volume equivalent to the Nile River. A floating plant would use the energy to process energy intensive products like CH₄, aluminum, H₂, and NH₃. If moored, it would connect to the onshore grid by means of undersea cable. A fixed plant would be built in shallow water and also be connected with the onshore grid by cable. Two designs for proof of principle OTEC plants of 40 MWe are being considered for construction by the U.S. government. Various special purpose remotely operated undersea mobile maintenance and construction machines are required if commercial status for OTEC is to be realized. M.S.K.

A83-27226

DEVELOPMENTS IN TIDAL POWER

R H CHARLIER (Northeastern Illinois University, Chicago, IL) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982, Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p 1437-1442. refs

Successful, planned, and potential tidal power plants and sites are discussed. Units are in operation in France and Russia, with the French plant using reversible blade turbines being used as a design guide for plants in Argentina and Australia. The U.S. is studying the feasibility of a plant in Passamaquoddy Bay, and Canada is pursuing construction of a plant in the Bay of Fundy. The Severn River in Great Britain is receiving a site study, and over a hundred plants have been built as local power systems in

05 ENERGY CONVERSION

China Bulb-type turbines, which enhance the volume emptying and filling the retaining basin, are considered as the highest performing power unit. Simpler one-way flow turbines have been suggested as more economical to install. Governmental, institutional, and investor impediments to tidal power plant are explored. M.S.K.

A83-27227

OTEC PLANTS FOR TODAY'S ISLAND MARKET

R NIEMANN, F DAVIS, L GENENS, D HILLIS, C PANCHAL, N SATHER, H STEVENS, and A THOMAS (Argonne National Laboratory, Argonne, IL). In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982, Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1448-1453 refs.

Design features of a proposed commercial 10 MWe OTEC power plant are presented. The plans rely on existing technology, with shore-basing in Hawaii, NH₃ in the coolant loop, a closed cycle, and a design life of 30 yr. Shell and the evaporators are adopted, together with periodic chlorination to prevent biofouling, and grid interconnect. Built with two 5 MWe modules, the OTEC system has hot and cold water pipes interfaced below sea level to wells, with one seawater pump for each heat exchanger. Ti tubes are featured in the evaporators and condensers. The 5300 ft cold water pipes descend to a 2100 ft depth, and are made of foam core fiberglass. The 350 ft warm water pipe has an intake at 35 ft depth and requires single-wall fiberglass construction. The total plant cost is projected as \$63.7 million, with power delivery costs of 17 cents/kWh. M.S.K.

A83-27265

WHENCE STIRLING ENGINES

W. R. MARTINI (Martini Engineering, Richland, WA). In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982, Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1669-1674. refs.

The Stirling engine, invented in 1816, was used from about 1860-WW I for machinery and households requiring a few kilowatts of power. The gasoline engine provided better efficiency and the electric motors to which they could be coupled were as silent as a Stirling engine. Development was revived in Holland in the 1930s to power radio transmitters silently, and the technology was carried over into compressors for producing liquefied air. Engines from 0.25-30 hp were produced in the 1940s, with efficiencies as high as in gasoline engines as well as compactness and silent operation. The invention of the rhombic drive permitted a perfectly balanced one-cylinder operation. Work has proceeded on Stirling engines for solar space power, train and submarine propulsion, and for military ground power units. A DOE program has led to an engine that can increase land vehicle propulsion efficiency by over 30%, but with a nearly doubling of the engine costs. Further work is recommended for producing Stirling cogeneration and biomass-burning engines. M.S.K.

A83-27266

WHITHER STIRLING ENGINES

W. R. MARTINI (Martini Engineering, Richland, WA). In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982, Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1675-1680 refs.

The operational principles of the Stirling engine are reviewed, along with possible applications. The working gas in a Stirling gas is contained between a hot piston and a cold piston. The space between contains the hot space, cold space, the heater, the regenerator, and the cooler. The heater is a heat exchanger between the working gas in the tubes and an external flame. Gas is heated, expands, moves the piston, is cooled, compressed, and is returned to the hot piston. Any heat source can be used, including coal, liquid and gaseous fuels, biomass, burnable trash, solar heat, stored thermal energy, and chemical reaction and

isotope heat, and at any temperature. A ceramic liner has been shown to allow efficiencies of 38% at 820 C in car engines, and improvements to 52.8% are foreseen. Applications for heat pumps, for driving electric motors in remote locations, and for power sources in the home, in small-scale commercial settings, and for centralized power plants are described. The only commercial use, currently, is for producing cryogenic fluids. M.S.K.

A83-27273

AN ASSESSMENT OF THE MULTIFUEL CAPABILITY AND ALTERNATIVE FUEL POTENTIAL OF THE AUTOMOTIVE STIRLING ENGINE /ASE/

P. L. SUTTON (U.S. Department of Energy, Office of Vehicle and Engine Research and Development, Washington, DC) and R. L. BECHTOLD (Mueller Associates, Inc., Baltimore, MD). In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982, Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1726-1731.

The results of a DOE study of the automotive Stirling engine in terms of fuel availability, fuel-related engine considerations, and the state of development of the Stirling engine for automotive uses are reported. Attention was also given to the multi-fuel capability of the engine, and parameters such as power output, emissions, fuel consumption, cold-start performance, reliability/durability, and materials compatibility were examined. Various hydrocarbon-based and alternative fuels were considered. It was concluded that the automotive Stirling engine has true multi-fuel capability, quality that will become more important as hydrocarbon-based fuels become depleted and other fuels are introduced. Block diagrams are presented of the engine design progress and level of thoroughness attained in the multi-fuel capability analyses. M.S.K.

A83-27275

FURTHER DEVELOPMENT OF THE FLUIDYNE LIQUID-PISTON ENGINE

M. J. ELSTON, M. S. LURIE, C. J. RALLIS, and D. B. KILGOUR (Witwatersrand, University, Johannesburg, Republic of South Africa). In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982, Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1755-1760.

The operational performance of a liquid-piston Stirling cycle engine is described. Oscillating fluid columns furnish the displacer and the power transmission functions. Details of a laboratory model are provided, including instrumentation for photography of the fluid oscillations in two columns, pressure measurements with piezoelectric transducers, and thermocouples to measure temperatures. Air leakage from the working space was a problem during tests at high pressures, and various floaters were examined as sealants. The best performance was found with a maximized working volume, which is suggested to be due to heat transfer to and from the working gas. An overall efficiency of 0.47% was obtained, along with a 53% Carnot efficiency for a head of 1.63 m and a flowrate of 73 ml/sec. The engine was concluded suitable for operation as a single-phase, single-component Stirling engine by addition of a float on the hot side liquid column, with optimized performance if the output column is tuned for resonance. M.S.K.

A83-27276

PERFORMANCE CHARACTERISTICS OF WET AND DRY FLUIDYNES

C. D. WEST (Westware Co., Oliver Springs, TN). In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982, Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1761-1765 refs.

Experimental and theoretical results are presented from consideration of Fluidyne engines with a two-component, two-phase cycle, forming effectively a Stirling cycle engine. Water vapor and water are the fluids, with the vapor escaping from the hot piston side. Also explored are a system with only water, called a dry

system, and a cycle with escaping vapor, referred to as a wet system. Losses due to liquid flow, hysteresis or transient heat transfer, and adiabatic processes are calculated, together with gross net output approximations. Overall efficiencies are obtained for engines with 150, 50, and 16 mm diam cylinders, each operating at 1.2, 0.85, and 0.5 Hz frequencies. The efficiency approximations provided are regarded as upper limits for experimental machines.

M S K.

A83-27277**DESIGN OF HYDRAULIC OUTPUT UNIT FOR 15 KW FREE-PISTON STIRLING ENGINE**

M A WHITE, S G EMIGH (Washington, University, Richland, WA), P RIGGLE (Associated Engineers, Richland, WA), and A BENNETT (Flow Industries, Kent, WA). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 1766-1771. refs

Design features and the performance of a long-life hydraulic converter developed for use in a 15 kW free-piston Stirling engine thermal dish are described. The design features flexibility in the choice of the converter piston mass and stroke, decouples the engine speed from the alternator speed through hydraulic accumulation, eliminates gas bearings and permanent magnets, and offers the option to counterbalance the power piston to eliminate vibration. Waste heat can be dumped with pumped hydraulic fluid, and a bellows seal permits an optimized choice of the bounce chamber gas, thus ending hysteresis problems encountered with He or hydrogen gas. A block diagram is presented of the system components, and results of a computer simulation are discussed. Overall efficiencies for the hydraulic converter are projected to be at least 93.5%.

M S K.

A83-27280**A NEW, VERSATILE STIRLING ENERGY CONVERSION UNIT**

R J. MEIJER and B ZIPH (Stirling Thermal Motors, Inc., Ann Arbor, MI). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 1801-1806. Research supported by the U.S. Department of Energy and Argonne National Laboratory.

Design features, projected performance, and applications of a 40 kW Stirling engine operating at 2800 rpm and currently under development are described. Remote heating using a heat pipe filled with condensing metal vapor has been incorporated in the design. The hot section is fed by heat obtained in an expansion heat exchanger. Details of the heat exchanger-stack configuration are provided. The engine has four cylinders which work in a double-acting mode. It contains a variable swashplate drive and power control in a pressurized 'crankcase'. Dimensions comprise a bore of 56 mm, stroke of 48 mm, 635 mm length, He as a working fluid, 75 kg weight, 11 MPa cycle pressure, 800 C heater temperature, heat transport using Na vapor, and iron and steel components. Life is expected to be 10,000 hr with a full load. Potential applications include driving commercial heat pumps, solar energy conversion, military portable power units, heat recovery, and rural power generation. Efficiencies will range from 35-48%, depending on the application.

M S K.

A83-27281**AN ISOTHERMAL SECOND-ORDER RINGBOM-STIRLING ENGINE COMPUTER PROGRAM**

V SRINIVASAN, R FAUVEL, G WALKER (Calgary, University, Calgary, Alberta, Canada), and W R MARTINI (Martini Engineering, Richland, WA). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 1807-1812. refs

Techniques employed to adapt isothermal analysis of a rhombic drive engine to a free displacer Ringbom-Stirling engine are

discussed. Particular attention is given to configurations which will allow coal-burning in fluidized bed combustion systems to power the engine. The 20 kW engine under development is a converted single-cylinder diesel engine modified to have a power piston with a pressurized space beneath. The diesel piston acts as a crosshead, allowing for flame heating. A second order isothermal analysis is used in computer simulations to consider air, He, or H₂ as the working gas. Acceptable accuracy has been demonstrated for performance and efficiency prediction, based on the parameters and historical experimental results with Stirling engines.

M S K.

A83-27282**50 KW STIRLING ENGINE**

T WATANABE, S YAMAGUCHI, K YAMAGUCHI, Y MOMOSE, S HARAMURA, T KONDOH, and Y ISHIZAKI (Aisin Seiki Co., Ltd., The Second Research and Development Center, Kariya, Aichi, Japan). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 1813-1818.

Experimental results with the MT79 Stirling engine are presented in terms of the power, torque, efficiency vs revolution, heat balance, the P-V diagram of the expansion space and compression space, and the noise level. The engine is rated at 50 kW/2500 rpm, is designed for a 31% efficiency at 700 rpm, and has a maximum torque of 30 kgf-m at 500 rpm. One design innovation has been a floating plate swashplate mechanism. Tests for 1000 hr used kerosene as the fuel and He as the working fluid. Power was found to be 52 kW at 2500 rpm, and all other design goals were met, as well as an effective pressure of 18 kgf/sq cm. Additionally, a 26% efficiency was maintained at 1000 rpm. The overall noise at 18 kW output was 78 dB. The engine is viewed favorably for marine or stationary applications, pending further reliability testing.

M S K.

A83-27284**DESIGN AND EXPERIENCES WITH A LABORATORY STIRLING CYCLE MACHINE**

D. H. RIX (Cambridge University, Cambridge, England). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 1823-1828. Science and Engineering Research Council of England. refs (Contract SERC-GR/B/23595)

The design of a laboratory Stirling cycle machine is described. Emphasis is given to the rather unorthodox design concept, which encompasses a two piston 'alpha' configuration, 'Ross' linkage drive mechanism, pressurized crankcase and a pressure balanced crankshaft gas seal. The special problems posed in the stressing of the pressurized components and drive system are discussed, as is the piston motion and the balancing of the mechanism. Finally some initial tests with the machine are described, in which air was used as the working fluid at a mean pressure of 1 bar.

(Author)

A83-27285**U.K. CONSORTIUM STIRLING ENGINE PROGRAMME**

G RICE (Reading, University, Reading, Berks, England). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 1829-1834. refs

This paper covers the design and construction of a high pressure helium-charged two cylinder 20 kW Stirling engine to be operated in either the alpha or gamma configuration. The design includes a sodium heat pipe head. A joint University/Industry Consortium was set up for the production of this research engine and the various contributions of the members are outlined in the paper. A dynamic test rig has been built to test regenerators and the paper illustrates the unique feature of this rig which enables measurement of the

05 ENERGY CONVERSION

enthalpy loss through the regenerator and its effectiveness

(Author)

A83-27286

A WAY TO RELAX THE DIMENSIONAL TOLERANCE REQUIREMENTS OF CLEARANCE REGENERATORS

E. H. COOKE-YARBOROUGH (Atomic Energy Research Establishment, Instrumentation and Applied Physics Div., Harwell, Oxon, England) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4 New York, Institute of Electrical and Electronics Engineers, 1982, p. 1835-1838.

In small Stirling engines, the gap between the displacer and cylinder is often made to function as the regenerator. The heat loss and the gas friction loss in this regenerator both vary very rapidly with changes in the clearance, so close tolerances are required in the dimensions and positioning of the displacer relative to the cylinder. It is shown that if the regenerator is split into two parallel channels by a thin-walled, stationary coaxial cylinder attached to, and accurately spaced from, the wall of the outer cylinder, then the tolerances in diameter and positioning of the displacer become much less critical. The overall performance of the regenerator can also be improved. (Author)

A83-27288* Rasor Associates, Inc., Sunnyvale, Calif

IMPROVED STIRLING ENGINE PERFORMANCE USING JET IMPINGEMENT

D. C. JOHNSON, E. J. BRITT (Rasor Associates, Inc., Sunnyvale, CA), and L. G. THIEME (NASA, Lewis Research Center, Cleveland, OH) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4 New York, Institute of Electrical and Electronics Engineers, 1982, p. 1845-1849. Research supported by the U.S. Department of Energy refs (Contract DEN3-177)

Of the many factors influencing the performance of a Stirling engine, that of transferring the combustion gas heat into the working fluid is crucial. By utilizing the high heat transfer rates obtainable with a jet impingement heat transfer system, it is possible to reduce the flame temperature required for engine operation. Also, the required amount of heater tube surface area may be reduced, resulting in a decrease in the engine nonswept volume and a related increase in engine efficiency. A jet impingement heat transfer system was designed by Rasor Associates, Inc., and tested in the GPU-3 Stirling engine at the NASA Lewis Research Center. For a small penalty in pumping power (less than 0.5% of engine output) the jet impingement heat transfer system provided a higher combustion-gas-side heat transfer coefficient and a smoothing of heater temperature profiles resulting in lower combustion system temperatures and a 5 to 8% increase in engine power output and efficiency. (Author)

A83-27290

BACK-TO-BACK TEST FOR DETERMINING THE PUMPING LOSSES IN A STIRLING CYCLE MACHINE

A. J. ORGAN, P. J. G. LONG (Cambridge University, Cambridge, England), and L. VASCIAVEO (Bari, Università, Bari, Italy) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4 New York, Institute of Electrical and Electronics Engineers, 1982, p. 1856-1861. Science and Engineering Research Council of England (Contract SERC-GR/B/23595)

In the 'back-to-back' test the thermal output of the compression-end heat exchanger is passed to the expansion end exchanger via an external coolant circuit. The net rate of heat addition to the coolant circuit is then the sum of the internal pumping power, the ideal (lossless) indicated power and the friction power. An experiment is described in which the effects of mechanical friction power and thermodynamic power are eliminated to reveal internal pumping power. Pumping power measured in this way is normalized and plotted as a function of two

dimensionless groups which have been found to characterize pumping losses. (Author)

A83-27294

DEVELOPMENT OF A STIRLING ENGINE ROD SEAL

M. G. SHORT (Royal Naval Engineering College, Plymouth, England) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1881-1884.

The development of a test apparatus for a 20 kW Stirling engine rod seals is described. Rod seals are essential to ensuring satisfactory lifetimes, high pressures, and low leakage rates in Stirling engines. The engine under test uses He as a working fluid at a pressure of 15 MN/sq.m. The full machine operation is detailed, noting the sprayed chromium finish on the steel rod to encourage formation of a sealant film during running. Reciprocating motion was provided by modifying a diesel engine driven by a dc motor. The seal cartridge was bolted to the cylinder head. Oil leakage rates were monitored at shaft speeds of up to 250 rpm, revealing that shaft performance at high rpm fell well below operational requirements. The tests were preliminary, and further developmental work will be performed to develop seals to satisfy operational criteria. M.S.K.

A83-27295

EFFECTS OF DISPLACER SEAL CLEARANCE ON FREE-PISTON STIRLING ENGINE PERFORMANCE

R. W. BERGGREN and T. M. MOYNIHAN (Mechanical Technology, Inc., Stirling Engine Systems Div., Latham, NY) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1885-1891. Research supported by the U.S. Department of Energy.

Test results and design features of the technology demonstration Stirling engine, which has run for 470 hr and produced 1 kWe when coupled to a linear alternator, are reported. The trials were performed with an adjustable gas spring to examine a wide range of piston/displacer dynamics. Measured power and efficiency were compared in operation at 500 C and at 450 C. Predictions were accurate for power output when the stroke was less than 2 cm, then deviated for higher strokes. It is suggested that a heat flow is present that has not yet been theoretically accounted for. The displacer seal clearance also had a significant effect on performance. A clearance of 0.51 mm produced good agreement between output predictions and measurements. Larger clearances severely degraded engine performance, indicating a necessity to control leakage in order to ensure efficient operation. M.S.K.

A83-27296

DIRECT CONVERSION NUCLEAR REACTOR SPACE POWER SYSTEMS

E. J. BRITT and G. O. FITZPATRICK (Rasor Associates, Inc., Sunnyvale, CA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4 New York, Institute of Electrical and Electronics Engineers, 1982, p. 1894-1901. refs

This paper presents the results of a study of space nuclear reactor power systems using either thermoelectric or thermionic energy converters. An in-core reactor design and two heat pipe cooled out-of-core reactor designs were considered. One of the out-of-core cases utilized long heat pipes (LHP) directly coupled to the energy converter. The second utilized a large number of smaller heat pipes (mini-pipe) radiatively coupled to the energy converter. In all cases the entire system, including power conditioning, was constrained to be launched in a single Shuttle flight. Assuming presently available performance, both the LHP thermoelectric system and minipipe thermionic system, designed to produce 100 kWe for seven years, would have a specific mass near 22 kg/kWe. The specific mass of the thermionic minipipe

system designed for a one year mission is 165 kg/kWe due to less fuel swelling. Shuttle imposed growth limits are near 300 kWe and 1.2 MWe and 1.2 MWe for the thermoelectric and thermionic systems, respectively. Converter performance improvements could double this potential, and over 10 MWe may be possible for very short missions. (Author)

A83-27297**DIRECT-ENERGY-CONVERSION IMPLICATIONS OF SPACE NUCLEAR REACTORS**

J F MORRIS (Arizona State University, Tempe, AZ) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 4 New York, Institute of Electrical and Electronics Engineers, 1982, p. 1902-1907 refs

Technology and research requirements necessary for producing space nuclear reactors for U.S. applications are discussed. Attention has been given to developing the SPAR reactor, a UO₂ fueled, sodium cooled space reactor that features Mo heat pipes for directing the reactor heat to thermionic converters. The rotating-bed reactor (RBR) concept has been projected to offer 500-1000 MWth output with 10 microsec rise times, and an ultimate output of upwards of 100 GWe. Power levels of up to 100 kWe could be attained with a modular minipipe reactor, featuring multiprong plug-in thermionic converters with radiation coupling and growth to 1.2 MWe. A complete reevaluation of all existing and new space nuclear reactor concepts and designs is recommended, together with consideration of building the machines to meet mission requirements. M.S.K.

A83-27298* Thermo Electron Corp., Waltham, Mass.

THERMIONIC TECHNOLOGY INFRASTRUCTURE FOR SPACE POWER

F HUFFMAN, P. REAGAN, G MISKOLCZY, and O MERRILL (Thermo Electron Corp., Waltham, MA) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1908-1912 refs
(Contract DE-AC02-76ET-11291; DE-AC02-81CS-90215, JPL-955009, NAS3-20270)

An assessment is made of the potential effectiveness, designs, and technological difficulties involved in the construction of space nuclear reactors coupled to thermionic energy converters (TEC). The TECs can be positioned either inside or outside of the reactor core. The out-of-core design lowers the reactor shielding requirements, as well as removing the need for mechanically pumped coolant for the reactor. R&D is still needed for the heat pipes for the reactor and the collectors, electrical insulation, and to reduce the potential losses in the interelectrode space. A cylindrical converter for the out-of-core configuration consists of a tungsten emitter heated by a tungsten-lithium heat pipe. The collector is a layer of tungsten oxide deposited on a Nb-1%Zr alloy, and has been tested at emitter temperatures of 1300-1850 K and a collector temperature range of 700-850 K. A design of a superheated thermionic converter is described, noting that a prototype has been operated at 1730 K for 12,000 hr. M.S.K.

A83-27299**THERMIONIC CONVERTERS FOR TERRESTRIAL APPLICATIONS**

D GOODALE, P REAGAN, D LIEB, and F HUFFMAN (Thermo Electron Corp., Waltham, MA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1913-1917. refs
(Contract DE-AC02-76ET-11292)

Performance data and post-test results of thermionic diodes subjected to long term high temperature tests are reported. A one inch diameter hemispheric converter with a CVD tungsten layer protected by a CVD SiC layer was subjected to 12,500 hr at 1730 K. The collector is Ni cooled with air, and a barrier index of

2.25 eV has been recorded at 1700 K, corresponding to an output of 2 W/sq cm at 0.25 V. No long-range degradation of the W-C interface was detected with scanning electron microscopy. Tests of six spherically shaped, two inch diameter converters with air cooled collectors have been tested at temperatures from 1400-1750 K. A cesium vapor was supplied from a reservoir and MoO coatings were used on the collectors. The power densities of the two inch diodes were less than in the one inch diodes, i.e., barrier indices below 2.2 eV were recorded. Fully activating the MoO layer is expected to lower the barrier and allow greater outputs. M.S.K.

A83-27300**COGENERATION USING A THERMIONIC COMBUSTOR**

G. MISKOLCZY and D. LIEB (Thermo Electron Corp., Waltham, MA) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1918-1923 refs
(Contract DE-AC02-76ET-11291)

A burner incorporating thermionic converters for both electricity and process heat at a manufacturing plant is described. Since thermionic converters operate at 1600-1800 K for the emitter and 800-1000 K at the collector, the cogeneration system is applicable for copper smelting, glass melting, commercial burners, steel smelting, and petroleum products manufacturing. Care must be taken to couple the heat transfer rates to the thermionic diode characteristics, with minimum air preheat temperatures necessarily above 1000 K and gas temperatures in the furnace at 1600 K. An analytical study is performed of the thermodynamics of the cogeneration cycle, and an example is provided of an application to a steel slab reheat furnace. Efficiencies of up to 90% are shown to be available for the entire cogeneration cycle if the reject heat is reused for process. M.S.K.

A83-27323**DEVELOPMENT OF THE WTS-4 WIND TURBINE DESIGN**

T. M. HASBROUCK and E. DIVALENTIN (United Technologies Corp., Hamilton Standard Div., Windsor Locks, CT) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 2106-2111

Design features, developmental aspects, and financial projections for the WTS-4 4 MW wind turbine are presented. The WTS-4 is a horizontal axis, downwind, two-bladed, variable pitch machine. Start-up is at 7 m/s, rated power is reached at 15 m/s, and shut-down is set at 27 m/s, with all controls operating in a stand-alone mode by means of microprocessors. Each blade is 125 ft long, constructed of filament wound fiberglass reinforced epoxy, and attached at the root to a teetered steel alloy hub, which compensates for the shear caused by the tower shadow. Pitch is controlled by an electrohydraulic mechanism, and can be effected at a rate of 5 deg/s. Details of the nacelle components and construction are provided, together with features of the system controller and design trade-offs. Cost comparisons with utility scale coal and oil baseload generation plants indicate that wind turbines will become cost competitive by 1985 and are favored thereafter. D.H.K.

A83-27324**LOW POWER, AIR-COOLED DC-LINK AIRCRAFT GENERATION SYSTEMS**

J F VONDEREMBSE and R J NISONGER (Westinghouse Electric Corp., Electrical Systems Div., Lima, OH) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 5. New York, Institute of Electrical and Electronics Engineers, 1982, p. 2114-2119.

A 10 kVa air-cooled DC-Link VSCF system with individually packaged components is described. The generator, power converter, and generator control unit (GCU) are discussed. The power converter components and functions include a rectifier

05 ENERGY CONVERSION

bridge/DC-Link filter, three-phase inverter, inverter waveform and output filter, neutral forming transformer, power stage sensing, and converter cooling. The GCU modules and functions include an inverter drive logic module, a voltage regulator module, protection module, built-in test/failure monitoring/annunciation, and cooling. The system can be readily uprated to a 20 dVA rating by an increase in generator capacity. The air-cooled configuration and lower rating permit the system to be implemented for an emergency power system at competitive cost and weight. CD

A83-27325

ON AERODYNAMIC DESIGN OF THE SAVONIUS WINDMILL ROTOR

O O MOJOLA (Ife, University, Ile-Ife, Nigeria) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 5. New York, Institute of Electrical and Electronics Engineers, 1982, p 2123-2129 refs

This paper examines under field conditions the performance characteristics of the Savonius windmill rotor. Test data were collected on the speed, torque and power of the rotor at a large number of wind speeds for each of seven values of the rotor overlap ratio. Field testing procedures are critically appraised and a unified approach is suggested. The performance data of the Savonius rotor are also fully discussed and design criteria established. (Author)

A83-27326*# National Aeronautics and Space Administration, Washington, D. C.

THE NASA PROGRAM IN SPACE ENERGY CONVERSION RESEARCH AND TECHNOLOGY

J P MULLIN, D J FLOOD, J H. AMBRUS, and W R HUDSON (NASA, Washington, DC) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 5. New York, Institute of Electrical and Electronics Engineers, 1982, p 2150-2162

The considered Space Energy Conversion Program seeks advancement of basic understanding of energy conversion processes and improvement of component technologies, always in the context of the entire power subsystem. Activities in the program are divided among the traditional disciplines of photovoltaics, electrochemistry, thermoelectrics, and power systems management and distribution. In addition, a broad range of cross-disciplinary explorations of potentially revolutionary new concepts are supported under the advanced energetics program area. Solar cell research and technology are discussed, taking into account the enhancement of the efficiency of Si solar cells, GaAs liquid phase epitaxy and vapor phase epitaxy solar cells, the use of GaAs solar cells in concentrator systems, and the efficiency of a three junction cascade solar cell. Attention is also given to blanket and array technology, the alkali metal thermoelectric converter, a fuel cell/electrolysis system, and thermal to electric conversion. G R.

A83-27327

DESIGN OPTIONS FOR THE SP-100 THERMOELECTRIC NUCLEAR SPACE POWER PLANT

D R KOENIG and W A RANKEN (Los Alamos National Laboratory, Los Alamos, NM) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 5. New York, Institute of Electrical and Electronics Engineers, 1982, p 2163-2168. Research sponsored by the US Department of Energy

Design options for the SP-100 Space Nuclear Power Plant (former SPAR) are reviewed that led to the current, radiatively coupled, baseline system design described in this paper. The selection of the radiative coupled configuration provides features that facilitate assembly, improves reliability and reduces the interactions between the nuclear and converter subsystem designs. Also the core design has continued to evolve incorporating individual fuel modules in the design. (Author)

A83-27328

A STUDY ON TWO-PHASE, TWO-COMPONENT STIRLING ENGINE

E IWASAKI and M HIRATA (Tokyo, University, Tokyo, Japan) In IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 5. New York, Institute of Electrical and Electronics Engineers, 1982, p 2169-2173

The characteristics of a Stirling engine of Freon (R-113)-Air mixture as a working fluid are studied. A small Stirling engine is designed. The engine rotates by itself only at some mixture ratio of Freon and air at a speed from 40 to 60 rpm when the temperature of the heater and cooler should be kept at 373 K and 288 K, respectively. By using a Freon-Air mixture, the average heat transfer coefficient at the heater wall is improved by a factor of 10, compared with using air only. In addition, the power output is positive even in the compression space. (Author)

A83-27329

LARGE PARABOLIC DISH COLLECTORS WITH SMALL GAS-TURBINE, STIRLING ENGINE OR PHOTOVOLTAIC POWER CONVERSION SYSTEMS

K GEHLISCH, H HEIKAL, A MOBARAK, and M SIMON (Institute for Solar Energy Technology, Munich, West Germany) In IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 5. New York, Institute of Electrical and Electronics Engineers, 1982, p 2186-2194 refs

A83-27868

AUGMENTATION OF POWER IN SLOW-RUNNING VERTICAL-AXIS WIND ROTORS USING MULTIPLE VANES

S SIVASEGARAM and S SIVAPALAN (Peradeniya, University, Peradeniya, Sri Lanka) Wind Engineering, vol 7, no 1, 1983, p 12-19 refs

Improving the sectional geometry of slow-running vertical-axis wind rotors of the Savonius type has resulted in considerable improvement in rotor performance. Further improvement in power output from a rotor of given overall dimensions demands the use of power augmenting systems. This paper presents a simple two-vane power augmentation system for rotors of the Savonius-type. The influence of important design parameters of the augmenting system and that of wind direction have been investigated and the system configuration giving maximum power augmentation has been determined. It is shown that an eighty percent increase in power output could be achieved using a pair of vanes of moderate size. (Author)

A83-27869

THE EFFECTS OF TOWER SHADOW ON THE DYNAMICS OF A HORIZONTAL-AXIS WIND TURBINE

S. R J POWLES (Cambridge University, Cambridge, England) Wind Engineering, vol 7, no 1, 1983, p 26-42 refs

Pitot tubes were employed to measure the shadow characteristics of lattice and tubular wind turbine towers in wind tunnel tests. Re of 140-50,000 and wind speeds of 9.13 and 7.40 m/sec were examined. General features of the shadow contours included a turbulent region up to 5 diam downstream and a steady widening of the shadow up to 3 diam downstream. The flexure of the blades was analyzed by computer simulations covering the wind shear, shadow, turbulence, and aerodynamic damping. It was found that areas of increased windspeeds extended 1-4 diameters on either side of the tower. The shadow produced bending and fatigue moments on the blades. Further tests are indicated to determine the frequencies and stresses of the moments acting on the blades passing through the shadow. M S K

A83-27870

MATHEMATICAL PROGRAMMING MODELS FOR THE ECONOMIC DESIGN AND ASSESSMENT OF WIND ENERGY CONVERSION SYSTEMS

K A REINERT (Granville Corp., Washington, DC) Wind Engineering, vol 7, no 1, 1983, p 43-59 refs

The use of linear decision rules (LDR) and chance constrained programming (CCP) to optimize the performance of wind energy conversion clusters coupled to storage systems is described. Storage is modelled by LDR and output by CCP. The linear allocation rule and linear release rule prescribe the size and optimize a storage facility with a bypass. Chance constraints are introduced to explicitly treat reliability in terms of an appropriate value from an inverse cumulative distribution function. Details of deterministic programming structure and a sample problem involving a 500 kW and a 1.5 MW WECS are provided, considering an installed cost of \$1/kW. Four demand patterns and three levels of reliability are analyzed for optimizing the generator choice and the storage configuration for base load and peak operating conditions. Deficiencies in ability to predict reliability and to account for serial correlations are noted in the model, which is concluded useful for narrowing WECS design options. M.S.K.

A83-27871

PROPOSAL FOR A NEW DESIGN OF WIND POWER GENERATOR

H H ROSENBROCK (Manchester, Victoria University, Manchester, England) Wind Engineering, vol 7, no 1, 1983, p 60-63

A wind turbine design which reduces the size of the actuator disk normally required for a given output from a wind turbine (WT) is presented. An annular enclosure is built around the WT. The annulus features stationary, radial, airfoil blades on the outer radius to provide a hollow cylinder of air with a low pressure center, into which the WT discharges. The WT essentially receives the wind power of a rotor with an actuator disk the size of the intake of the annular space. An example is a 16 m diam rotor running at 300 rpm, surrounded by a 100 m o.d. annulus producing 100 MW between 15-50 m/sec. Fewer fluctuating stresses would be imparted to the blades. Analytical justification for the projections is made through application of the Bernoulli theorem. M.S.K.

A83-28300

EVALUATION OF TETRAFLUORETHANE-1,2-DISULFONIC ACID AS A FUEL CELL ELECTROLYTE

P N ROSS, JR (California, University, Berkeley, CA) Electrochemical Society, Journal, vol 130, Apr 1983, p 882-885 refs

(Contract DE-AC03-76SF-00098)

Some physical properties of tetrafluorethane-1,2-disulfonic acid (TFDSA) relevant to fuel cell use are examined, and preliminary results are reported on the testing of this electrolyte in fuel cells with hydrogen containing carbon monoxide. It is concluded from an examination of these data that because of poor conductivity at high concentrations, TFDSA offers no advantage over H₃PO₄ in fuel cell applications where system considerations favor cell temperatures above 120°C. V.L.

A83-28643#

DISCHARGES IN THE INLET REGION OF A NOBLE GAS MHD GENERATOR

C A BORGHI (Eindhoven, Technische Hogeschool, Doctor in de technische Wetenschappen Dissertation, 1982. 125 p. Research supported by the Commission of the European Communities, Technische Hogeschool Eindhoven, and Consiglio Nazionale delle Ricerche refs

The onset of the development of the nonequilibrium conductivity in the entrance region of a noble gas MHD generator is investigated both theoretically and experimentally. A self-consistent model of a stationary discharge in an Ar-Cs mixture at atmospheric pressure is set up. Deviations from the Maxwellian shape of the electron distribution are included in a model to calculate the time dependence of the electron density and of the populations of excited states following a change in the electron energy. The

theory predicts an increase of the characteristic time for ionization relaxation. A stationary arc discharge and its afterglow are investigated in an experiment. In the stationary situation, values of the electron density from 4×10^{10} to the 20th down to 1×10^{10} to the 20th per cubic meter have been obtained. LTE is observed during stationary discharge. An experimental study of the transition from low to high current in the MHD generator is also described. A longer relaxation length is observed for a low inlet value with a non-Maxwellian electron distribution. C.D.

A83-28956#

JOULE HEATING EFFECTS IN MHD GENERATOR BOUNDARY LAYERS

R K JAMES and C H KRUGER (Stanford University, Stanford, CA) AIAA Journal (ISSN 0001-1452), vol 21, May 1983, p. 679-686 refs

(Contract EX-76-C-01-2341; NSF AER-72-03487)

The temperature and electron number density profiles of the boundary layers in a laboratory-scale magnetohydrodynamic (MHD) electric power generator were measured. Comparisons between calculations from a two-dimensional theory and measurements for cases without current were found to show generally good agreement when the turbulence model properly accounted for the effects of freestream turbulence, although small discrepancies were observed between theory and experiments for the overall profile shape. Comparisons of experimental temperature profiles without current were found to show a marked temperature increase in the boundary layer due to Joule heating. The two-dimensional boundary layer theory provided good predictions of the magnitude of the increase, although measured temperature profiles with current and magnetic field did not agree with predictions. The predicted profile in the inner region of the boundary layer for a case with current and magnetic field was determined to be above a similar case without current, whereas measurements for anode boundary layers were below control profiles without current. A cathode boundary layer was shown to behave oppositely to the anode boundary layer. N.B.

A83-29013#

18:1 PRESSURE RATIO AXIAL/CENTRIFUGAL COMPRESSOR DEMONSTRATION PROGRAM

J K SCHWEITZER (United Technologies Corp., Government Products Div., West Palm Beach, FL) and J. W. FAIRBANKS (U.S. Department of Energy, Office of Coal Utilization, Washington, DC) Journal of Aircraft (ISSN 0021-8669), vol 20, May 1983, p 404-410

(Contract DE-AC05-76OR-05035)

Previously cited in issue 19, p 3356, Accession no. A81-40899

A83-29089

THE GENERATION OF ELECTRIC CURRENTS BY THE TURBULENT FLOW OF DIELECTRIC LIQUIDS. I - LONG PIPES

H L WALMSLEY (Shell Research, Ltd., Thornton Research Centre, Chester, England) Journal of Physics D - Applied Physics (ISSN 0022-3727), vol 15, Oct 14, 1982, p 1907-1934 refs

A theoretical model has been developed for the electric currents generated by the turbulent flow of fluids through long smooth pipes. The model equations have been solved numerically for a wide range of Reynolds numbers and conductivities and four approximate solutions with more limited ranges of application have been derived. One of the approximate solutions, the intermediate Conductivity solution, is potentially useful in predicting currents for conditions in which electrostatic hazards may occur. Our model solutions preserve those aspects of earlier calculations that are in agreement with experiment, but also predict some experimentally observed features, such as polarity changes, that are not explained by the earlier work. At high conductivities there are some discrepancies between our theory and experiment. These probably occur because the experiments were carried out in pipes that were hydraulically rough, whereas the theory was derived for smooth pipes. Author

05 ENERGY CONVERSION

A83-29897* General Electric Co., Schenectady, N Y **CONTROL DESIGN AND PERFORMANCE ANALYSIS OF A 6 MW WIND TURBINE-GENERATOR**

A MURDOCH, J R WINKELMAN, S. H JAVID (General Electric Co., Schenectady, NY), and R S BARTON (General Electric Co., Valley Forge, PA) (Institute of Electrical and Electronics Engineers, Summer Meeting, San Francisco, CA, July 18-23, 1982) IEEE Transactions on Power Apparatus and Systems (ISSN 0018-9510), vol PAS-102, May 1983, p. 1340-1347 refs
(Contract DEN3-153)

This paper discusses an approach to the modeling and performance for the preliminary design phase of a large (6.2 MW) horizontal axis wind turbine generator (WTG). Two control philosophies are presented, both of which are based on linearized models of the WT mechanical and electrical systems. The control designs are compared by showing the performance through detailed non-linear time simulation. The disturbances considered are wind gusts, and electrical faults near the WT terminals. Author

N83-16343*# Garrett Turbine Engine Co., Phoenix, Ariz. **A METHOD TO ESTIMATE WEIGHT AND DIMENSIONS OF SMALL AIRCRAFT PROPULSION GAS TURBINE ENGINES: USER'S GUIDE Final Report**

P L HALE Aug 1982 136 p refs

(Contract NAS3-23037)

(NASA-CR-168049, NAS 1 26 168049, GARRETT-21-4270-1 1)

Avail NTIS HC A07/MF A01 CSDL 21E

The weight and major envelope dimensions of small aircraft propulsion gas turbine engines are estimated. The computerized method, called WATE-S (Weight Analysis of Turbine Engines-Small) is a derivative of the WATE-2 computer code. WATE-S determines the weight of each major component in the engine including compressors, burners, turbines, heat exchangers, nozzles, propellers, and accessories. A preliminary design approach is used where the stress levels, maximum pressures and temperatures, material properties, geometry, stage loading, hub/tip radius ratio, and mechanical overspeed are used to determine the component weights and dimensions. The accuracy of the method is generally better than + or - 10 percent as verified by analysis of four small aircraft propulsion gas turbine engines. S L

N83-16470# Central Electricity Generating Board, London (England) Translations Section

EVALUATION OF DETERIORATION DUE TO HOT CREEP IN CHROME-MOLYBDENUM FERRITIC STEELS USED IN THERMAL POWER STATIONS

C. CASTANI, M LIVRAGHI, and V REGIS 1982 25 p Transl into ENGLISH from La Met Ital (Italy), no 9, 1976 p 425-433 (BLL-CE-TRANS-7669-(9022 09)) Avail: British Library Lending Div., Boston Spa, Engl

The long term deterioration due to hot creep in metallic materials used at high temperatures in thermal power stations is investigated. The checking of the state of the tubes which convey the steam from the boiler to the turbine is of fundamental importance, both as regards safety and for calculations to predict the operating life of the plants. The design calculations, nondestructive tests on plant, and destructive tests on materials which were in service are verified. The validity of certain methodologies are checked. The results of destructive tests carried out on two lengths of type 1 Cr 1/2 Mo ferritic steel taken on the steam line of a 65MW thermal unit are presented. S L

N83-16515# Southwest Research Inst., San Antonio, Tex **METALLURGICAL INVESTIGATION OF DISC CRACKING IN THE LP-2 TURBINE AT A NUCLEAR POWER STATION Final Report**

H C BURGHARD Jul 1982 128 p refs Sponsored by Electric Power Research Inst

(Contract EPRI PROJ 1398-7)

(DE82-906428, EPRI-NP-2269) Avail. NTIS HC A07/MF A01

An investigation of combined face cracking and rim cracking in discs of an LP steam turbine rotor was performed. The incident in question involved the development of major cracks in the

hub/web transition on the outlet face of the disc as well as major cracking of the blade attachment steeples. Both types of cracking occurred in the No. 1 discs at both ends of a particular rotor. The program was based on a metallurgical evaluation of hub and rim samples of discs removed from the turbine rotor after approximately 31,000 hours of operation. In-depth metallographic and fractographic examinations of representative face cracks and rim cracks were conducted. In addition, the mechanical properties and chemical composition of each of the disc samples were determined. Analyses of crack surface deposits and bulk turbine deposits were also performed. DOE

N83-16556# Mound Lab., Miamisburg, Ohio. **MASS BALANCE RESULTS FOR THE PRICETOWN 1 UNDERGROUND COAL GASIFICATION FIELD TEST**

A K. AGARWAL, P W SEABAUGH, and R E. ZIELINSKI 1981 160 p refs

(Contract DE-AC04-76DP-00053)

(DE82-005667, NLH-NU-81-72-0002) Avail NTIS HC A08/MF A01

A mass balance model was applied to the Pricetown 1 test data. This model provided values of various parameters such as water influx, percent gasification, amount of coal affected, thermal efficiency, etc., for the various phases of the test. Both hourly and daily values of the test data were used. At certain times, there was air loss to the coal seam or air gain from the coal seam as related to the underground reactor. Mass balances were modified accordingly. Realistic pyrolysis temperatures were chosen for the different phases of the test based on the thermocouple responses. The nitrogen and argon balances provided similar results. The mass balance results showed that approximately 702 tons of coal were affected during the test. Approximately 266 tons of coal were completely gasified. The reverse combustion linkage through the virgin coal seam was dominated by the devolatilization and accounted for approximately 80% devolatilization whereas only 26% devolatilization occurred during the gasification phase. DOE

N83-16557# Pacific Northwest Lab., Richland, Wash **STEAM GASIFICATION OF WOOD IN THE PRESENCE OF CATALYSTS**

D H MITCHELL, L K. MUDGE, and E G BAKER 1981 29 p refs Presented at the 13th Biomass Thermochemical Conversion Contractors' Meeting, Arlington, Va., 27-30 Oct 1981

(Contract DE-AC06-76RL-01830)

(DE82-005919, PNL-SA-9954, CONF-8110115-4) Avail NTIS HC A03/MF A01

Catalytic steam gasification of wood, including sawdust, chipped forest slash, and mill shavings, is discussed. Results of laboratory, process development unit (PDU), and feasibility studies illustrate attractive processes for conversion of wood to methanol and a substitute natural gas (SNG). Recent laboratory studies developed a long lived alloy catalyst for generation of a methanol synthesis gas by steam gasification of wood. Modification of the PDU for operation at 10 atm (150 psia) is nearly complete. The modified PDU will be operated at the elevated pressure to confirm yields and design parameters used in process feasibility studies. Feasibility studies were completed on wood to methane (SNG) and wood to methanol plants with capacities of 2000 and 200 oven dried tons (1800 and 180 metric t) per day using catalytic gasification. The results showed that generation of methanol on the large scale is economically viable today while SNG generation is competitive with future prices. DOE

N83-16855*# National Aeronautics and Space Administration, Washington, D. C.
CONSTRUCTION, TESTING AND DEVELOPMENT OF LARGE WIND ENERGY FACILITIES

R WINDHEIM, ed and R. CUNTZE, ed Sep 1982 412 p
 Transl. into ENGLISH of proceedings of a Seminar on Energy Res (West Germany), rept Juel-Spez-138, 1981 p 1-415 Seminar held in Juelich, West Germany, 23-24 Mar. 1981 Transl. by Scientific Translation Service, Santa Barbara, Calif (Contract NASW-3542)
 (NASA-TM-76933, NAS 1.15.76933, JUEL-SPEZ-138) Avail NTIS HC A18/MF A01 CSCL 10A

Building large rotor blades and control of oscillations in large facilities are discussed. It is concluded that the technical problems in the design of large rotor blades and control of oscillations can be solved
 Author

N83-16857*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CONSTRUCTION OF LOW-COST, MOD-OA WOOD COMPOSITE WIND TURBINE BLADES

R. F. LARK 1983 17 p refs Proposed for presentation at the 28th Natl SAMPLE Symp. and Exposition, Anaheim, Calif, 12-14, 1983
 (Contract DE-AI01-76ET-20320)
 (NASA-TM-83046, E-1493; DOE/NASA/20320-42, NAS 1.15:83046) Avail NTIS HC A02/MF A01 CSCL 10A

Two sixty-foot, low-cost, wood composite blades for service on 200 kW Mod-OA wind turbines were constructed. The blades were constructed of epoxy resin-bonded Douglas fir veneers for the leading edge sections, and paper honeycombed, birch plywood faced panels for the afterbody sections. The blades were joined to the wind turbine hub by epoxy resin-bonded steel load take-off studs embedded into the root end of the blades. The blades were installed on the 200 kW Mod-OA wind turbine facility at Kahuku, Hawaii. The blades completed nearly 8,000 hours of operation over an 18 month period at an average power of 150 kW prior to replacement with another set of wood composite blades. The blades were replaced because of a corrosion failure of the steel shank on one stud. Inspections showed that the wood composite structure remained in excellent condition
 Author

N83-16859*# Westinghouse Electric Corp., Pittsburgh, Pa
 Advanced Systems Div

THE MOD-OA 200 KILOWATT WIND TURBINE GENERATOR DESIGN AND ANALYSIS REPORT Final Report

T S ANDERSEN, C. A BODENSCHATZ, A G EGGERS, P. S HUGHES, R. F LAMPE, M H LIPNER, and J R SCHORNHORST Aug 1980 68 p refs
 (Contract DEN3-163; DE-AI01-76ET-20370)
 (NASA-CR-165127, DOE/NASA/0163-1, NAS 1.26.165127; AESD-TME-3051) Avail NTIS HC A04/MF A01 CSCL 10A

The project requirements, approach, system description, design requirements, design, analysis, system tests, installation safety considerations, failure modes and effects analysis, data acquisition, and initial performance for the MOD-OA 200 kw wind turbine generator are discussed. The components, the rotor, driven train, nacelle equipment, yaw drive mechanism and brake, tower, foundation, electrical system, and control systems are presented. The rotor includes the blades, hub and pitch change mechanism. The drive train includes the low speed shaft, speed increaser, high speed shaft, and rotor brake. The electrical system includes the generator, switchgear, transformer, and utility connection. The control systems are the blade pitch, yaw, and generator control, and the safety system. Manual, automatic, and remote control and Dynamic loads and fatigue are analyzed
 E A K

N83-16861# R and D Associates, Arlington, Va
RESEARCH NEEDS: PRIME-POWER FOR HIGH ENERGY SPACE SYSTEMS Final Report, 26 Oct. 1981 - 31 Jul. 1982

P J TURCHI Jul 1982 100 p refs
 (Contract F49620-82-C-0008; AF PROJ 2301)
 (AD-A120209, RDA-TR-120900-001, AFOSR-82-0875TR) Avail NTIS HC A05/MF A01 CSCL 22B

By the year 2000, an increasingly large portion of our national defense will depend on space-based systems. As part of a broader set of new research initiatives in support of space systems, the Air Force Office of Scientific Research is sponsoring basic research that may be applicable to the development of megawatt-level space prime-power systems. The emphasis of this particular new initiative is prime-power versus pulsed power including power conditioning, such as flywheel or inductive storage, for which there are existing programs
 GRA

N83-16864# Physical Sciences, Inc., Woburn, Mass
HOT-GAS CLEANUP FOR MOLTEN-CARBONATE FUEL CELLS Quarterly Report, 19 May - 31 Jul. 1981

A GELB, D HAM, P LEWIS, G LORD, and G. SIMONS Nov 1981 30 p refs
 (Contract DE-AC21-81MC-16242)
 (DE82-002500, DOE/MC-16242-1, PSI-TR-289, QR-1) Avail NTIS HC A03/MF A01

Progress on task 1 (high temperature chlorine cleanup) is reported. Findings include (1) the primary candidates for chloride cleanup are the alkali and alkaline earth carbonates or oxides, (2) ZnCl₂ and FeCl₃ are gaseous above 800 K and melt below 600 K, which could have severe implications for cleanup of sulfur with Zn/Fe oxides from streams where chloride is present, (3) very little information is available on kinetics and pore plugging of sorbents during chloride cleanup; and (4) the alkali carbonates appear to be by far the best sorbents for combined sulfur/chloride cleanup. Progress is also reported on task 2, soot control for molten carbonate fuel cell anode. Experiments run with various gas mixtures on smooth Ni surfaces, supported Ni catalyst and anode material have led to the conclusion that the Boudouard reaction for carbon deposition is much faster at fuel cell conditions than either the water shift reaction or the methanation reaction.
 DOE

N83-16867# Sperry Research Center, Sudbury, Mass
SPEERY LOW-TEMPERATURE GEOTHERMAL CONVERSION SYSTEM. VOLUME 1: ORGANIC-WORKING-FLUID PROPERTIES Final Report

C. CARROLL, K R HULES, R LANGLEY, B TOEKES, and D P WILSON 1981 135 p refs
 (Contract DE-AC03-78ET-27125)
 (DE82-018529, DOE/ET/27125-T1-VOL-1, SRC-CR-81-74-VOL-1) Avail NTIS HC A07/MF A01

Measurements of the physical properties of R-114 refrigerant in the compressed liquid and dense gas regions are reported. Included are experimental studies of the thermodynamic properties of R-114, enthalpy measurement by throttling experiment, engineering model of the thermodynamic properties of R-114, feasibility study to dissociate R-114 with a four cycle gasoline engine, transport properties of R-114, analytical procedure to determine impurities in R-114, toxicological information on Freons, and a literature search of published properties of R-114, other refrigerants, and other potential working fluids
 DOE

N83-16880# Oak Ridge National Lab., Tenn Energy Div
HYDRAULIC AIR COMPRESSOR FOR OCEAN THERMAL ENERGY CONVERSION APPLICATIONS

F C CHEN and A GOLSHANI 1981 12 p refs Presented at the 4th Intern Conf on Alternative Energy Sources, Miami Beach, Fla, 14-16 Dec 1981
 (Contract W-7405-ENG-26)
 (DE82-005198; CONF-811212-5) Avail NTIS HC A02/MF A01

A hydraulic air compressor, which requires no mechanical moving parts, but only a downward flow of water to accomplish air compression and which operates at a nearly isothermal mode,

05 ENERGY CONVERSION

can be an alternative for the noncondensable gas disposal of an Ocean Thermal Energy Conversion (OTEC) open-cycle power system. An air compressor test loop was assembled and operated to obtain test data that would lead to the design of an OTEC hydraulic air compressor. A one-dimensional, hydraulic gas compressor computer model was employed to simulate the laboratory experiments. Based on the computer model and the preliminary test results the feasibility of optimizing the performance of an OTEC noncondensable gas disposal system using a hydraulic air compressor was assessed DOE

N83-16883# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst

WIND SYSTEM VALUE ANALYSIS FOR ELECTRIC UTILITIES: A COMPARISON OF FOUR METHODS

J HARPER, D PERCIVAL, T FLAIM, and R L SULLIVAN (Florida Univ) Nov 1981 14 p refs Presented at the 5th Biann Wind Workshop and Conf, Washington, D.C., 5-7 Oct. 1981 (Contract DE-AC02-77CH-00178) (DE82-006963, SERI/TP-214-1464, CONF-811043) Avail: NTIS HC A02/MF A01

The only known effort that used more than a single methodology for the value analysis of wind energy conversion systems (WECS) to a specific utility is discussed. The WECS utility value analysis methodologies of Aerospace Corp., JBF Scientific Corp., and the Solar Energy Research Institute (SERI) are discussed. Results of the application of these three methodologies were found for two large utilities. Break-even values (the amount a utility can pay for a wind turbine over its lifetime and still breakeven economically) were found to be from \$1600 to \$2400 per kW of wind capacity in 1980 dollars. The reasons for variation in the results are discussed. DOE

N83-16901# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho

PERFORMANCE AND OPERATIONAL EXPERIENCE OF A PROTOTYPE BINARY GEOTHERMAL POWER PLANT

G L MINES 1981 20 p Presented at the IECEC Conf, Atlanta, 9 Aug 1981 (Contract DE-AC07-76ID-01570) (DE82-006289, EGG-M-01581, CONF-810812-41) Avail: NTIS HC A02/MF A01

The production of electric power from a moderate temperature geothermal resource was investigated. The initial production of electrical power was accomplished with the prototype power plant which was built to demonstrate the operation of binary power cycles where the energy in the geothermal fluid is transferred to a secondary working fluid. During the automatic run test the plant produced a maximum of 59kW(e). During the automatic run test, the plant operation was stable and the facility was operated for 1357 hours producing electrical power approximately 87% of the time geothermal fluid was available for operation. GRA

N83-16904# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho

ANALYSES OF MIXED HYDROCARBON BINARY THERMODYNAMIC CYCLES FOR MODERATE TEMPERATURE GEOTHERMAL RESOURCES

O J DEMUTH 1981 6 p refs Presented at the IECEC Conf, Atlanta, 9 Aug 1981 (Contract DE-AC07-76ID-01570) (DE82-006272, CONF-810812-42) Avail: NTIS HC A02/MF A01

A number of binary geothermal cycles utilizing mixed hydrocarbon working fluids were analyzed with the overall objective of finding a working fluid which can produce low-cost electrical energy using a moderately low temperature geothermal resource. Both boiling and supercritical shell-and-tube cycles were considered. The hydrocarbon working fluids analyzed included methane, ethane, propane, isobutane, isopentane, hexane, heptane, and mixtures of those pure hydrocarbons. For comparison, two fluorocarbon refrigerants were also analyzed. Preliminary estimates of relative heat exchanger size (product of overall heat transfer coefficient times heater surface area) were made for a

number of the better performing cycles. For the 280 F resource, a mixture of 90% propane and 10% isopentane in a supercritical cycle showed the highest value of net geofluid effectiveness of the working fluids assessed. The more promising of the cycles employing mixed hydrocarbon working fluids require heaters which are estimated to range from seven to approximately 50% larger in total surface area than those for the reference cycles. DOE

N83-16915# Power Math Associates, Inc., Tempe, Ariz. **SECURITY ASSESSMENT OF POWER SYSTEMS INCLUDING ENERGY STORAGE AND WITH THE INTEGRATION OF WIND ENERGY. VOLUME 1: DIGITAL TRANSIENT SIMULATION EFFORT CONSULTING AGREEMENT NUMBER 1 Final Report**

P M ANDERSON 30 Jun 1982 275 p refs (Contract DE-AC02-77ET-29100) (DE82-021063, DOE/ET-29100/21-VOL-1) Avail: NTIS HC A12/MF A01

The purpose of the effort reported was to adapt the MOD-2 simulation models for implementation on a digital transient stability program. This has involved: selection of an appropriate host program, examination of the host program interface, analysis of the analog models for digital implementation, FORTRAN coding of the model equations, installation and debugging on the host program, and final model verification. Synchronous machine equations are analyzed, with particular emphasis on numerical solution. DOE

N83-16922# California Univ., Livermore. Lawrence Livermore Lab

ENERGY AND TECHNOLOGY REVIEW

I F STOWERS, ed. Jan 1982 36 p refs (Contract W-7405-ENG-48) (DE82-011840, UCRL-52000-82-1) Avail: NTIS HC A03/MF A01

Three research programs at Lawrence Livermore Laboratory are described. The solid-state microscope, specifically designed for computer input, enables automated high-resolution population screening for blood-cell abnormalities or early signs of cancer. Nonmedical applications appear possible in powder metallurgy, geology, and semiconductor fabrication. The studies of ion-atom collisions led to improved atomic-structure measurements, new techniques for determining elemental composition, and better x-ray detector calibrations. A new and promising source of high-power laser radiation has characteristics that may make it feasible for the production of fusion power on a commercial scale. DOE

N83-16932# Columbia Gas Corp., Ohio. System Service Div **RESEARCH, DEVELOPMENT AND DEMONSTRATION OF AN ADVANCED ACTUATED HEAT PUMP Annual Report, Oct. 1980 - Sep. 1981**

F B COOK, A R MONTERO, and E M PURVIS, JR Apr 1982 58 p refs (Contract GRI-5080-341-0344) (PB82-254590, GRI-80/0137) Avail: NTIS HC A04/MF A01 CSCL 13A

The research, development and demonstration of the basic heat pump refrigeration circuit and the heat exchange interface with the controlled and ambient environments in both cooling and heating modes of operation are discussed. The basic refrigeration circuit uses a high efficiency absorption process with a novel absorbent/refrigerant pair. A full sized breadboard model of the refrigeration cycle was designed and fabricated. A test program is underway. In addition to the basic cycle development and test program, four hardware development and four supporting data development subcontract programs are underway. Hardware development includes interface heat exchangers, recuperative heat exchangers, a solution pump and an automatic control system. GRA

N83-16935# Wisconsin Univ., Madison Inst for Environmental Studies.

AN ASSESSMENT OF WIND CHARACTERISTICS AND WIND ENERGY CONVERSION SYSTEMS FOR ELECTRIC UTILITIES
C C. DEWINKEL Jun 1982 175 p refs

(Contract EPA-R-803971)

(PB82-258971; EPA-600/3-82-066) Avail: NTIS HC A08/MF A01 CSCL 10B

Evaluation of wind speed data from 12 airport sites in Wisconsin, Minnesota, Iowa, and Illinois and from five Coast Guard stations along Lakes Superior and Michigan, indicates annual average wind speeds of 4.5 to 6 m/s and wind power densities of 100 to 200 W per sq m at 7 m height. The economic analysis of wind energy conversion systems (WECS) applied to the Dairyland Power Cooperative (DPC) system indicates that it can be economically attractive for the DPC to install WECS in the 1980's. A preliminary study of WECS in combination with directly controlled water heaters shows that this combined system may delay conventional generating capacity additions longer than will controlled heaters only. Author (GRA)

N83-16937# Johns Hopkins Univ., Laurel, Md.

OCEAN THERMAL ENERGY AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Report, Jan. - Mar. 1982

1982 42 p refs

(PB82-257536, JHU/APL/OQR/82-1) Avail: NTIS HC A03/MF A01 CSCL 10A

An ocean thermal energy conversion (OTEC) pilot plant conceptual design review is given. OTEC methanol production from coal is discussed. A review of electrolyzer development programs and requirements is given. Financial and legal considerations in OTEC implementation, potential navy sites for GEOTEC system, hybrid geothermal-OTEC power plants, single-cycle performance estimates, and supervision of testing of a pneumatic wave energy conversion system are discussed. GRA

N83-16938# National Bureau of Standards, Washington, D.C.
ECONOMIC EVALUATION OF SOLAR ENERGY SYSTEMS IN COMMERCIAL BUILDINGS: METHODOLOGY AND CASE STUDIES Final Report

R T RUEGG, G T SAV, J W. POWELL, and E. T. PIERCE Jul 1982 207 p refs. Sponsored in part by DOE

(PB82-260456, NBSIR-82-2540) Avail: NTIS HC A10/MF A01 CSCL 13A

A comprehensive economic optimization model for evaluating the economic feasibility of active solar energy systems to provide service hot water and combined space heating and service hot water in commercial buildings is given. The model is demonstrated in a number of case studies for office buildings and retail stores. Data and assumptions for use in the model are compiled for the selected case studies. Using these data, the model is applied to estimate present value net savings (or net losses) of the solar energy systems over a 20 year life cycle. Break even values for hot water loads, solar energy systems costs, and current and future energy prices are also calculated to determine the minimum conditions under which the solar energy systems become cost effective for the selected buildings. Author (GRA)

N83-16941# National Oceanic and Atmospheric Administration, Washington, D C. Office of Ocean Minerals and Energy
OCEAN THERMAL ENERGY CONVERSION: ENVIRONMENTAL EFFECTS ASSESSMENT PROGRAM PLAN, 1981 - 1985

Jun 1982 63 p refs

(PB82-258047, NOAA-82072903) Avail: NTIS HC A04/MF A01 CSCL 10B

A generic plan regarding the environmental effects of ocean thermal energy conversion (OTEC) is discussed. The plan has the primary objective of obtaining the environmental information and knowledge required to allow the commercial development of OTEC to the maximum extent that is compatible with acceptable environmental risk. This plan describes the program of research for FY 1981 to 1985 that is necessary to begin to assess the

effects on the environment of ocean thermal energy conversion facilities and plantships. GRA

N83-16944# Mechanical Technology, Inc., Latham, N Y.

RANKINE/RANKINE CYCLE GAS-FIRED HEAT PUMP Final Report, Mar. 1979 - Mar. 1982

E. ENBAR, R. MORIARTY, and T IVSAN 30 Jun. 1982 267 p refs. Sponsored in part by New York State Energy Research and Development Authority, Albany

(Contract GRI-5011-341-0149)

(PB82-254640, MTI-82TR-3; GRI-82/0014) Avail: NTIS HC A12/MF A01 CSCL 13A

A Rankine/Rankine cycle gas-fired heat pump was developed for residential application. The system consists of two rotating elements: a high-speed turbomachine core and a low-speed assembly, which includes a rotating vapor generator and heat exchangers. Inherent in the rotation of these components is the elimination of separate pumps, fans, reversing valves, and expansion valves. One Rankine cycle, the power cycle, drives the turbine and gives up its excess heat to the service air. The second Rankine cycle, the refrigerant cycle, is pressurized by a turbine-powered centrifugal compressor. The dual-cycle system uses two organic heat transfer fluids. The power cycle uses a developmental, moderate-temperature fluid (designated Fluid B), and the refrigeration cycle uses Freon R-113. GRA

N83-17026# Johns Hopkins Univ., Baltimore, Md. Program of Civil Engineering

SIMULATION OF WIND-SPEED TIME SERIES FOR WIND-ENERGY CONVERSION ANALYSIS Final Report

R B COROTIS Jun 1982 78 p refs. Prepared for Pacific Northwest Laboratory, Richland, Wash.

(Contract DE-AC06-76RL-01830)

(DE83-000043, PNL-4349) Avail: NTIS HC A05/MF A01

Sequential wind speeds recorded to investigate the operating characteristics of a wind energy conversion system. When data records are not available statistical characteristics of the wind speed data to calibrate a stochastic model and then generate a simulated wind speed time series are used. A simple wind speed simulation model, WEISIM, is developed based on the Weibull probability distribution for wind speeds with a correction based on the lag one autocorrelation value. The model simulates rates from one a second to one an hour, and wind speeds represent short term averages or longer term averages. The validity of the model is verified with PNL data for both histogram characteristics and persistence characteristics. DOE

N83-17325# Princeton Univ., N. J. Plasma Physics Lab

THE STELLARATOR APPROACH TO TOROIDAL PLASMA CONFINEMENT

J. L. JOHNSON Nov. 1981 72 p refs

(DE82-005727; PPPL-1856) Avail: NTIS HC A04/MF A01

An overview is presented of the development and current status of the stellarator approach to controlled thermonuclear confinement. Recent experimental, theoretical, and systems developments have made this concept a viable option for the evolution of the toroidal confinement program. Some experimental study of specific problems associated with departure from two-dimensional symmetry must be undertaken before the full advantages and opportunities of steady-state, net-current-free operation can be realized. Author

N83-17330# California Univ., Livermore Lawrence Livermore Lab

COATINGS FOR LASER FUSION

W. H. LOWDERMILK 18 Dec 1981 32 p refs. Presented at the SPIE Optical Coatings for Energy Efficiency and Solar Appl Conf., Los Angeles, 25-29 Jan 1982

(Contract W-7405-ENG-48)

(DE82-005698, UCRL-87037, CONF-820107-2) Avail: NTIS HC A03/MF A01

Optical coatings are used in lasers systems for fusion research to control beam propagation and reduce surface reflection losses

05 ENERGY CONVERSION

The performance of coatings is important in the design, reliability, energy output, and cost of the laser systems. Significant developments in coating technology are required for future lasers for fusion research and eventual power reactors DOE

N83-17331# Idaho National Engineering Lab., Idaho Falls.

OVERVIEW OF FUSION REACTOR SAFETY

S. COHEN and J. G. CROCKER 1981 15 p refs Presented at the 6th Intern. Conf. on Structural Mech. in Reactor Technol., Paris, 17-21 Aug 1981

(Contract DE-AC07-76ID-01570)

(DE82-005951; CONF-10801-59) Avail NTIS HC A02/MF A01

Use of deuterium-tritium fusion reactors requires examination of several major safety and environmental issues: (1) tritium inventory control; (2) neutron activation of structural materials, fluid streams and reactor hall environment, (3) release of radioactivity from energy sources including lithium spill reactions, superconducting magnet stored energy release, and plasma disruptions; (4) high magnetic and electromagnetic fields associated with fusion reactor superconducting magnets and radio frequency heating devices; and (5) handling and disposal of radioactive waste. Early recognition of potential safety problems with fusion reactors provides the opportunity for improvement in design and materials to eliminate or greatly reduce these problems. With an early start in this endeavor, fusion should be among the lower risk technologies for generation of commercial electrical power DOE

N83-17423*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.

COMPUTER PROGRAM FOR STIRLING ENGINE PERFORMANCE CALCULATIONS Final Report

R. C. TEW, JR Jan 1983 100 p refs

(Contract DE-AI01-77CS-51040)

(NASA-TM-82960; DOE/NASA/51040-42, E-1377, NAS 1 15.82960) Avail NTIS HC A05/MF A01 CSCL 10B

The thermodynamic characteristics of the Stirling engine were analyzed and modeled on a computer to support its development as a possible alternative to the automobile spark ignition engine. The computer model is documented. The documentation includes a user's manual, symbols list, a test case, comparison of model predictions with test results, and a description of the analytical equations used in the model S.L.

N83-17424*# Garrett Turbine Engine Co., Phoenix, Ariz Engineering Staff

ADVANCED GAS TURBINE (AGT) POWERTRAIN SYSTEM DEVELOPMENT FOR AUTOMOTIVE APPLICATIONS Semiannual Progress Report, Jul. - Dec. 1981

Jul 1982 79 p refs Sponsored in part by DOE

(Contract DEN3-167)

(NASA-CR-167983, DOE/NASA/0167-82/4; NAS 1 26 167983, GARRETT-31-3725(4); SAPR-4) Avail NTIS HC A05/MF A01 CSCL 13F

A gas turbine powertrain for automobiles with reduced fuel consumption and reduced environmental impact is investigated. The automotive gas turbine, when installed in an automobile (3000 pounds inertia weight), provides a CFDC fuel economy of 42.8 miles per gallon based on EPA test procedures and diesel No. 2 fuel. The AGT powered vehicle substantially gives the same overall vehicle driveability and performance as a comparable production vehicle powered by a conventional spark ignition powertrain system. The emissions are less than federal standards, and a variety of fuels can be used S.L.

N83-17522# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany) Unternehmensbereich Drehfluegler.

FORCE INITIATIONS IN HELICOPTER ROTOR BLADES, WIND CHANNEL FANS AND WIND TURBINES [KRAFTEINLEITUNGEN IN BLAETTER FUER ROTOREN VON HUBSCHRAUBERN, WINDKANALGEBLAESEN UND WINDTURBINEN]

HAHN 26 May 1982 28 p refs In GERMAN Presented at DGLR Symp. on Entwicklung und Anwendung von CFK-Strukt., Stuttgart, 26-27 May 1982

(MBB-UD-356-82-O) Avail: Issuing Activity

The force initiations in fiber reinforced composite rotor blades for front and rear helicopter rotors, wind tunnel fan rotors, and wind energy turbines were investigated. The force initiations are determined by the blade technology as well as by the rotor hub design. Blade connection domains were proposed, which in their construction and design propose different solutions, corresponding to the different applications. Glass fiber reinforced composites, carbon fiber reinforced composites and mixed constructions with manually impregnated laminates and prepreps were studied. Statistical force initiation calculations were compared with tests on specimen and components Author (ESA)

N83-17905# Stuttgart Univ (West Germany) Inst fuer Statik und Dynamik.

ARLIS 1.0: LINEAR INVESTIGATION OF AEROELASTIC SYSTEMS IN ROTATION [ARLIS 1.0: AEROELASTISCHE ANALYSE ROTIERENDER LINEAR SYSTEME]

J. H. ARGYRIS and B. KIRCHGAESSNER 1982 162 p refs In GERMAN, ENGLISH summary

(Contract BMFT-ET-4406-A/B)

(ISD-293, ISSN-0170-6071) Avail NTIS HC A08/MF A01

A program system for linear investigation of the dynamic behavior of wind energy converters is described. Tower and rotor are coupled modally to obtain linearized equations of motion of the entire system. The investigation of stability is performed according to Floquet's theory because these equations of motion contain cyclic coefficients. The theory, a program and some examples which were investigated are described. E.A.K.

N83-18022*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

EVALUATION OF PRODUCTION VERSION OF THE NASA IMPROVED INORGANIC-ORGANIC SEPARATOR

D. SHEIBLEY Jan 1983 28 p refs

(NASA-TM-83018; E-1453, NAS 1.15 83018) Avail NTIS HC A03/MF A01 CSCL 10A

The technology of an inorganic-organic (I/O) separator, which demonstrated improved flexibility, reduced cost, production feasibility and improved cycle life was developed. Substrates to replace asbestos and waterbased separator coatings to replace the solvent based coatings were investigated. An improved fuel cell grade asbestos sheet was developed and a large scale production capability for the solvent based I/O separator was demonstrated. A cellulose based substrate and a nonwoven polypropylene fiber substrate were evaluated as replacements for the asbestos. Both the cellulose and polypropylene substrates were coated with solvent based and water based coatings to produce a modified I/O separator. The solvent based coatings were modified to produce aqueous separator coatings with acceptable separator properties. A single ply fuel cell grade asbestos with a binder (BTA) was produced. It has shown to be an acceptable substrate for the solvent and water based separator coatings, an acceptable absorber for alkaline cells, and an acceptable matrix for alkaline fuel cells. The original solvent based separator (K19W1), using asbestos as a substrate, was prepared. S.L.

N83-18024* # National Aeronautics and Space Administration
Langley Research Center, Hampton, Va

SEMICONDUCTOR PHOTOELECTROCHEMISTRY

A. M. BUONCRISTIANI (Christopher Newport Coll.) and C. E. BYVIK Jan. 1983 94 p refs

(Contract NSG-1514)

(NASA-TP-2088, L-15495, NAS 1 60 2088) Avail: NTIS HC

A05/MF A01 CSCL 10A

Semiconductor photoelectrochemical reactions are investigated. A model of the charge transport processes in the semiconductor, based on semiconductor device theory, is presented. It incorporates the nonlinear processes characterizing the diffusion and reaction of charge carriers in the semiconductor. The model is used to study conditions limiting useful energy conversion, specifically the saturation of current flow due to high light intensity. Numerical results describing charge distributions in the semiconductor and its effects on the electrolyte are obtained. Experimental results include an estimate rate at which a semiconductor photoelectrode is capable of converting electromagnetic energy into chemical energy, the effect of cell temperature on the efficiency, a method for determining the point of zero zeta potential for macroscopic semiconductor samples; a technique using platinized titanium dioxide powders and ultraviolet radiation to produce chlorine, bromine, and iodine from solutions containing their respective ions; the photoelectrochemical properties of a class of layered compounds called transition metal thiophosphates, and a technique used to produce high conversion efficiency from laser radiation to chemical energy. S L

N83-18028# Aeronautical Research Inst of Sweden, Stockholm
Structures Dept

AEROELASTIC STABILITY AND DYNAMIC RESPONSE ANALYSIS OF THE LDB-125 VERTICAL AXIS WIND TURBINE

A. VOLLAN (ASS Consulting, Hagnan, West Ger) Aug 1982 57 p refs

(Contract NE-5061-452)

(FFA-TN-1982-19) Avail: NTIS HC A04/MF A01

The stability and the dynamic response behavior of the proposed vertical axis wind turbine LDB-125 was investigated. The LDB rotor imposes many new and unconventional features like double L blades, inclined tower, rotating base, extensive use of guy wire. A dynamic response and stability analysis was performed using a complex calculation model to minimize the risk of neglecting significant physical effects. It is shown, that the LDB-125 rotor has no instabilities or dangerous resonance regions in the normal operating range of rotational velocity. E A K

N83-18030# Stuttgart Univ (West Germany) Inst fuer Statik und Dynamik

LINEAR STATIC AND DYNAMIC ANALYSIS FOR HINGED ROTOR BLADES OF 60 M SPAN FOR A TWO BLADED HORIZONTAL AXIS WIND ENERGY CONVERTER

J. H. ARGYRIS, K. A. BRAUN, and B. KIRCHGAESSNER 1981 53 p refs Presented at vonKarman Inst Lecture Ser 1981-8 on Wind Energy Conversion Devices, Rhode Saint Genese, Belg, 1-5 Jun 1981

(Contract BMFT-ET-4086-A)

(ISD-291, ISSN-0170-6071) Avail: NTIS HC A04/MF A01

The linear static and dynamic behavior of a rotor blade of a horizontal axis wind energy converter with flap and lag hinges and with coupling of flap and pitch was investigated. The linearized equations of motion are developed using a finite element idealization considering quasisteady aerodynamic forces. The complex eigenfrequencies are calculated. The time history response of the rotor blade is computed for cyclic gravitational loads at rated operation and for a global gust. The stresses at selected points along the blade and forces and moments acting on the tower are calculated from the structural deformation. E A K

N83-18071# Midwest Research Inst, Golden, Colo Solar Energy Research Inst.

THE ENERGY OF THE OCEAN THERMAL RESOURCE AND THE SECOND-LAW EFFICIENCY OF IDEALIZED OCEAN THERMAL ENERGY CONVERSION POWER CYCLES

D. H. JOHNSON Sep 1982 38 p refs Revised

(Contract DE-AC02-77CH-00178)

(DE83-000449, SERI/TR-252-142OR-REV) Avail: NTIS HC A03/MF A01

A formula is developed to compute the maximum amount of work which can be extracted from a given combined mass of warm and cold ocean water (a quantity called the energy of the ocean thermal resources). Second it compares the second-law efficiencies of various proposed ocean thermal energy conversion power cycles to determine which best utilizes the energy of the ocean thermal resource. The second-law efficiencies of the multicomponent working fluid cycle, the Beck cycle, and the open and closed single- and multiple-stage Rankine cycles are compared. These types of OTEC power plants are analyzed in a consistent manner which assumes that all deviations from a plant making use of all the energy (one with a second-law efficiency of 100%) occurs because of irreversible transfer of heat across a finite temperature difference. Conversion of thermal energy to other forms is assumed to occur reversibly. The comparison of second-law efficiencies of various OTEC power cycles shows that the multistage Rankine open cycle with just three stages has the potential of best using the energy of the ocean thermal resource. DOE

N83-18079# Oak Ridge National Lab, Tenn Engineering Physics Div.

EVALUATION OF THE MATHEMATICAL AND ECONOMIC BASIS FOR CONVERSION PROCESSES IN THE LEAP ENERGY-ECONOMY MODEL

E. M. OBLow Oct 1982 31 p refs

(Contract W-7405-ENG-26)

(DE83-001706, ORNL/TM-8178) Avail: NTIS HC A03/MF A01

An evaluation was made of the mathematical and economic basis for conversion processes in the Long-term Energy Analysis Program (LEAP) energy economy model. Conversion processes are the main modeling subunit in LEAP used to represent energy conversion industries and are supposedly based on the classical economic theory of the firm. Questions about uniqueness and existence of LEAP solutions and their relation to classical equilibrium economic theory prompted the study. An analysis of classical theory and LEAP model equations was made to determine their exact relationship. The conclusions drawn from this analysis were that LEAP theory is not consistent with the classical theory of the firm. Specifically, the capacity factor formalism used by LEAP does not support a classical interpretation in terms of a technological production function for energy conversion processes. The economic implications of this inconsistency are suboptimal process operation and short term negative profits in years where plant operation should be terminated. A new capacity factor formalism, which retains the behavioral features of the original model, is proposed to resolve these discrepancies. DOE

N83-18084# Westinghouse Electric Corp, Pittsburgh, Pa Research and Development Center

EVALUATION OF GASIFICATION AND GAS-CLEANUP PROCESSES FOR USE IN MOLTEN-CARBONATE FUEL-CELL POWER PLANTS Quarterly Technical Progress Report, Oct. - Dec. 1981

1981 53 p refs

(Contract DE-AC21-81MC-16220)

(DE82-012244, DOE/MC-16220/T3, QTPR-3) Avail: NTIS HC A04/MF A01

A choice of the gasifier/cleanup system combinations most suitable for molten carbonate fuel cell based power plant application is discussed. Included are hot gas cleanup, air blown, oxygen blown and molten salt based coal gas supply systems. An assessment of deposition for power plant size molten carbonate fuel cells is given and mechanisms affecting particle transfer in

05 ENERGY CONVERSION

fuel cells are described Gas cleanup to remove virtually all particles larger than one micron in diameter is expected to prevent, or at least minimize to a negligibly low level, deposition of particulate material on the anode However, cathode particulate deposition in molten carbonate fuel cells should be evaluated in the future, since cathodes are more likely to experience deposition even though cathode channel particle concentrations can be much lower than anode channel concentrations Cathodes are more susceptible to deposition than anodes due to a net mass flow of gases into cathode pores compared to a net mass flow of gases out from anode pores. DOE

N83-18172# Technische Hochschule, Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie
DESIGN AND STANDARDIZATION OF METEOROLOGICAL MEASUREMENTS FOR WIND ENERGY CONVERTING SYSTEMS Final Report, Nov. 1981

P. A. W. COPPIN, G. TETZLAFF, and R. ROTH Bonn Bundesministerium fuer Forschung und Technologie Sep. 1982 66 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie (BMFT-FB-T-82-168, ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 14

The systematic error for several standard anemometers was investigated The efficiency of wind energy converters can only be measured if several requirements for the topographic forms, surface coverage, stationarity of the wind field and turbulence intensity are met. It is only then that the standard models describing wind field properties are applicable and errors do not exceed 3% The wind speed sensors should not exhibit a systematic error Under simplified conditions three anemometers are sufficient to get reliable data on the overall efficiency of almost every wind energy converting system. E.A.K

N83-18451# Korea Advanced Energy Research Inst., Seoul
SURVEY OF NUCLEAR FUSION TECHNOLOGY. A PROSPECT ANALYSIS OF TOKAMAK FUSION RESEARCH
W. K. HWANG 1981 74 p refs In KOREAN, ENGLISH summary (DE82-700131, KAERI/RR-275/80) Avail: NTIS (US Sales Only) HC A04/MF A01, DOE Depository Libraries

The fusion research evaluation model for analyzing various R and D scenarios, the trend analysis of Tokamak research, and the near-term technologies are discussed A computer code, FUSREV, was developed It consists of the plasma power model and the cost/benefit model Since the state-of-the-arts which are expected to be achieved as the result of subproject R and D's can only be obtained in the form of probability distribution functions Monte Carlo method is employed The test computation of the code shows acceptable results. However, FUSREV was continuously modified employing new models for both technology and economics DOE

N83-18511# Mound Lab., Miamisburg, Ohio
TRITIUM TRANSPORT AND CONTROL IN THE FED
M. L. ROGERS 1981 4 p Presented at the 9th Symp on Eng Probl. of Fusion Res., Chicago, 26 Oct 1981 (Contract DE-AC04-76DP-00053) (DE82-002592; MLM-2871(OP), CONF-811040-60) Avail: NTIS HC A02/MF A01

The tritium systems for the FED have three primary purposes The first is to provide tritium and deuterium fuel for the reactor This fuel can be new tritium or deuterium delivered to the plant site, or recycled DT from the reactor that must be processed before it can be recycled The second purpose of the FED tritium systems is to provide state-of-the-art tritium handling to limit worker radiation exposure and to minimize tritium losses to the environment The final major objective of the FED tritium systems is to provide an integrated system test of the tritium handling technology necessary to support the fusion reactor program Every effort is being made to incorporate available information from the Tritium System Test Assembly (TSTA) at Los Alamos National Laboratory, the Tokamak Fusion Test Reactor (TFTR) tritium

systems, and the tritium handling information generated within DOE for the past 20 years DOE

N83-18512# Los Alamos Scientific Lab., N Mex
UTILIZATION OF THE CATALYZED-DD FUEL CYCLE IN REVERSED-FIELD PINCH REACTORS (RFPRs)
R. L. HAGENSON and R. A. KRAKOWSKI 1981 7 p refs Presented at the Alternate Fuels Reactor Workshop, La Jolla, Calif., 7-8 Dec 1981 (Contract W-7405-ENG-36) (DE82-010425, LA-UR-82-207; CONF-811228-1) Avail: NTIS HC A02/MF A01

The utilization of deuterium-based fuels offers the potential advantages of greater flexibility in blanket design, significantly reduced tritium inventory, potential reduction in radioactivity level, and utilization of an inexhaustible fuel supply The extension of the conventional DT-fueled Reversed-Field Pinch Reactor (RFPR) designs to advanced-fuel (catalyzed-DD) operation has recently been reported Attractive and economically competitive DD/RFPR systems are identified having power densities and plasma parameters comparable to the DT systems These designs are compared to other fusion reactor designs DOE

N83-18940# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Faculty of Thermodynamics and Internal Combustion Engines

SUPERCHARGING WITH COMPREX

M. BERCHTOLD In Von Karman Inst. for Fluid Dyn Turbochargers and Related Probl 22 p 1982 refs Avail: NTIS HC A18/MF A01

The use of a pressure wave energy exchanger called Comprex as an exhaust gas driven diesel engine supercharger is discussed The mode of operation is described The matching of the Comprex to engine demands, especially the requirement that it operate over a wide range, is discussed R.J.F.

N83-19099# Raymond Engineering Lab., Inc., Middletown, Conn.

A STUDY OF BOLTING PROBLEMS, TOOLS, AND PRACTICES IN THE NUCLEAR INDUSTRY Final Report

M. E. LOORAM, J. H. BICKFORD, J. L. SEMINARA, and J. R. LETH Dec 1981 139 p refs Sponsored by EPRI (DE82-902203, EPRI-NP-2174) Avail: NTIS HC A07/MF A01

Bolting, tensioning, and torquing practices in nuclear power plants are summarized The value of assigning a specific individual or team to study plant bolting problems emphasized since there is an indication the industry is often not using equipment which is now state-of-the-art With training, effective equipment, and adequate procedures, the industry can benefit from reduced errors, improper tensioning, less leakage problems and fewer strains and injury to personnel. DOE

N83-19102# Boyce Engineering International, Inc., Houston, Tex

EXTERNAL COMBUSTION STEAM INJECTED GAS TURBINE Final Report

Jul 1982 243 p refs (Contract DE-AC01-80ET-15234) (DE82-019862, DOE/ET-15234/T1) Avail: NTIS HC A11/MF A01

An external combustion steam injected (ECSI) gas turbine was designed and developed The system involves both the fuel flexibility and cogeneration concepts The technical feasibility of the system and insight to the problems associated with the system were examined The basic system involves using a heat exchanger in which the combustor output is used to heat the air input to the gas turbine and also to produce steam that may be used for steam injection and steam start Combustion products never enter the gas turbine Cycle analysis of the ECSI system, design concepts for the overall system and for the gas turbine and heat exchanger, instrumentation and control equipment, performance testing and test results are presented The Externally Fired Steam Injected Turbine has produced 320HP output at overall thermal efficiencies

of 30%. The concept is judged to be technically feasible, has fuel flexibility, can be converted to conventional firing, and is usable for the cogeneration of heat and electric power. DOE

N83-19226*# Budd Co., Fort Washington, Pa
DESIGN AND EVALUATION OF LOW-COST STAINLESS STEEL FIBERGLASS FOAM BLADES FOR LARGE WIND DRIVEN GENERATING SYSTEMS Final Report
 W. S. EGGERT, JR Oct 1982 57 p refs
 (Contract DEN3-129, DE-AI01-79ET-20320)
 (NASA-CR-165491, DOE/NASA/0129-1) Avail NTIS HC A04/MF A01 CSCL 10A

A low cost wind turbine blade based on a stainless steel fiberglass foam Budd blade design concept, was evaluated for its principle characteristics, low cost features, and its advantages and disadvantages. A blade structure was designed and construction methods and materials were selected. A complete blade tooling concepts, various technical and economic analysis, and evaluations of the blade design were performed. A comprehensive fatigue test program is conducted to provide data to verify the design stress allowables. E.A.K.

N83-19228*# STD Research Corp., Arcadia, Calif
ANALYTICAL INVESTIGATION OF CRITICAL MHD PHENOMENA Final Annual Report, Sep. 1980 - Sep. 1981
 Sep 1981 37 p refs
 (Contract DEN3-202, DE-AI01-77ET-10769)
 (NASA-CR-168079, NAS 1 26 168079; DOE/NASA-0202-1; STDR-82-15) Avail NTIS HC A03/MF A01 CSCL 10A

Development and analysis of schemes for suppression of the startup overvoltage transient in the AEDC High Performance Demonstration Experiment (HPDE), analysis of performance enhancement due to electrode voltage drop reduction by use of pyrolytic graphites in the HPDE, prediction of optimal loading schemes for the HPDE, prediction of PHDE performance with a diagonal electrical connection, and predictions of the likelihood and effects of axial current leakage between adjacent electrodes in the HPDE are reviewed. Simulations of tests at the AEDC/HPDE with STD Research Corporation multidimensional and time dependent computer codes provided additional validation for the computer codes and shed light on physical mechanisms which govern performance and durability of MHD power generators. The magnetoaerothermal effect was predicted by STD Research Corporation to have a significant effect on the HPDE/MHD generator performance at high interaction. Author

N83-19229# Committee on Governmental Affairs (U. S. Senate)
CRITICAL NEED FOR ENERGY RESEARCH AND DEVELOPMENT: THE ROLE OF THE MIDWEST RESEARCH LABORATORIES
 Washington GPO 1982 136 p Hearing before the Subcomm. on Energy, Nucl. Proliferation and Govt Process of the Comm on Govt Affairs, 97th Congr, 2d Sess, 22 Mar 1982 (GPO-11-308) Avail. Subcommittee on Energy, Nuclear Proliferation and Government Processes

The need for government support of energy research and development is discussed. The role of the Midwest Research Labs is considered. S L

N83-19231*# National Aeronautics and Space Administration
 Lewis Research Center, Cleveland, Ohio.
LARGE HORIZONTAL-AXIS WIND TURBINES
 R. W. THRESHER, ed (Oregon State Univ., Corvallis) 1982 823 p refs Workshop held in Cleveland, 28-30 Jul 1981 Sponsored in part by DOE
 (NASA-CP-2230, NAS 1 55 2230, CONF-810752, SERI/CP-635-1273) Avail NTIS HC A99/MF A01 CSCL 10A

The proceedings of a workshop held in Cleveland, July 28-30, 1981 are described. The workshop emphasized recent experience in building and testing large propeller-type wind turbines, expanding upon the proceedings of three previous DOE/NASA workshops at which design and analysis topics were considered. A total of 41

papers were presented on the following subjects: current and advanced large wind turbine systems, rotor blade design and manufacture, electric utility activities, research and supporting technology, meteorological characteristics for design and operation, and wind resources assessments for siting.

N83-19232*# National Aeronautics and Space Administration
 Lewis Research Center, Cleveland, Ohio
THE RESPONSE OF A 38M HORIZONTAL AXIS TEETERED ROTOR TO YAW

J. C. GLASGOW, H. G. PFANNER, and E. J. WESTERKAMP *In its Large Horizontal-Axis Wind Turbines* p 53-67 1982 refs
 Avail NTIS HC A99/MF A01 CSCL 10A

Recent tests on the 38m Mod-0 100 kW horizontal axis experimental wind turbine yielded quantitative data on the teeter response of a rotor to yaw. The test results indicate that yaw rates as high as 5 deg/s could be used in emergency situations to unload and slow a rotor for intermediate sized (500 kW) wind turbines. The results also show that teeter response is sensitive to the direction of yaw, and that teeter response to yaw is reduced as either the rotor speed or the blade lock number is increased. Author

N83-19233*# National Aeronautics and Space Administration.
 Lewis Research Center, Cleveland, Ohio.
FIXED PITCH ROTOR PERFORMANCE OF LARGE HORIZONTAL AXIS WIND TURBINES

L. A. VITERNA and R. D. CORRIGAN *In its Large Horizontal-Axis Wind Turbines* p 69-85 1982 refs
 Avail NTIS HC A99/MF A01 CSCL 10A

Experimental fixed pitch wind turbine performance data is presented for both the DOE/NASA Mod-0 and the Danish Gedser wind turbines. Furthermore, a method for calculating the output power from large fixed pitch wind turbines is presented. Modifications to classical blade element momentum theory are given that improve correlation with measured data. Improvement is particularly evident in high winds (low tip speed ratios) where aerodynamic stall occurs as the blade experiences high angles of attack. Author

N83-19234*# National Aeronautics and Space Administration
 Lewis Research Center, Cleveland, Ohio
STALL INDUCED INSTABILITY OF A TEETERED ROTOR

J. C. GLASGOW and R. D. CORRIGAN *In its Large Horizontal-Axis Wind Turbines* p 87-100 1982 refs
 Avail NTIS HC A99/MF A01 CSCL 10A

Recent tests on the 38m Mod-0 horizontal experimental wind turbine yielded quantitative information on stall induced instability of a teetered rotor. Tests were conducted on rotor blades with NACA 230 series and NACA 643-618 airfoils at low rotor speeds to produce high angles of attack at relatively low wind speeds and power levels. The behavior of the rotor shows good agreement with predicted rotor response based on blade angle of attack calculations and airfoil section properties. The untwisted blades with the 64 series airfoil sections had a slower rate of onset of rotor instability when compared with the twisted 230 series blades, but high teeter angles and teeter stop impacts were experienced with both rotors as wind speeds increased to produce high angles of attack on the outboard portion of the blade. The relative importance of blade twist and airfoil section stall characteristics on the rate of onset of rotor instability with increasing wind speed was not established, however. Blade pitch was shown to be effective in eliminating rotor instability at the expense of some loss in rotor performance near rated wind speed. Author

05 ENERGY CONVERSION

N83-19235*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio.

FREE YAW PERFORMANCE OF THE MOD-0 LARGE HORIZONTAL AXIS 100 KW WIND TURBINE

R. D. CORRIGAN and L. A. VITERNA *In its* Large Horizontal-Axis Wind Turbines p 103-122 1982 refs

Avail: NTIS HC A99/MF A01 CSCL 10A

The NASA Mod-0 Large Horizontal Axis 100 kW Wind Turbine was operated in free yaw with an unconed teetered, downwind rotor mounted on a nacelle having 8-1/2 deg tilt. Two series of tests were run, the first series with 19 meter twisted aluminum blades and the second series with 19 meter untwisted steel spar blades with tip control. Rotor speed were nominally 20, 26 and 31 rpm. It was found the nacelle stabilized in free yaw at a yaw angle of between -55 deg to -45 deg was relatively independent of wind speed and was well damped to short term variations in wind direction. Power output of the wind turbine in free yaw, aligned at a large yaw angle, was considerably less than that if the wind turbine were aligned with the wind. For the Mod-0 wind turbine at 26 rpm, the MOSTAB computer code calculations of the free yaw alignment angle and power output compare reasonably well with experimental data. MOSTAB calculations indicate that elimination of tilt and adding coning will improve wind turbine alignment with the wind and that wind shear has a slight detrimental effect on the free yaw alignment angle.

Author

N83-19236*# Westinghouse Electric Corp., Pittsburgh, Pa **MULTIPLE AND VARIABLE SPEED ELECTRICAL GENERATOR SYSTEMS FOR LARGE WIND TURBINES**

T. S. ANDERSEN, P. S. HUGHES, H. S. KIRSCHBAUM, and G. A. MUTONE *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 125-136 1982 refs

Avail: NTIS HC A99/MF A01 CSCL 10A

A cost effective method to achieve increased wind turbine generator energy conversion and other operational benefits through variable speed operation is presented. Earlier studies of multiple and variable speed generators in wind turbines were extended for evaluation in the context of a specific large sized conceptual design. System design and simulation have defined the costs and performance benefits which can be expected from both two speed and variable speed configurations.

Author

N83-19241*# Kaman Aircraft Corp., Bloomfield, Conn **FIBERGLASS COMPOSITE BLADES FOR THE 2 MW MOD-1 WIND TURBINE GENERATOR**

W. R. BATESOLE *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 215-238 1982 refs

Avail: NTIS HC A99/MF A01 CSCL 10A

In mid-1979, NASA contracted with Kaman Aerospace Corporation for the design, manufacture, and ground testing of two 100 foot composite rotor blades intended for operation on the Mod-1 wind turbine. The Mod-1 blades have been completed and are currently stored at the Kaman facility. The design, tooling, fabrication, and testing phases which have been carried out to date, as well as testing still planned are described. Discussed are differences from the 150 foot blade which were introduced for cost and manufacturing improvement purposes. Also included is a description of the lightning protection system installed in the blades, and its development program. Actual costs and manhours expended for Blade No. 2 are provided as a base, along with a projection of costs for the blade in production. Finally, cost drivers are identified relative to future designs.

Author

N83-19242*# Structural Composites Industries, Inc., Azusa, Calif **LOW-COST COMPOSITE BLADES FOR THE MOD-0A WIND TURBINES**

O. WEINGART *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 239-258 1982 refs

Avail: NTIS HC A99/MF A01 CSCL 10A

Low cost approaches to the design and fabrication of blades for a two-bladed 200 kW wind turbine were identified and the applicability of the techniques to larger and smaller blades was

assessed. Blade tooling was designed and fabricated. Two complete blades and a partial blade for tool tryout were built. The patented TFT process was used to wind the entire blade. This process allows rapid winding of an axially oriented composite onto a tapered mandrel, with tapered wall thickness. The blade consists of a TFT glass-epoxy airfoil structure filament wound onto a steel root end fitting. The fitting is, in turn, bolted to a conical steel adapter section to provide for mounting attachment to the hub. Structural analysis, blade properties, and cost and weight analysis are described.

M G

N83-19243*# Hamilton Standard, Windsor Locks, Conn
Wind Energy Systems Div.

FIBERGLASS COMPOSITE BLADES FOR THE 4 MW - WTS-4 WIND TURBINE

R. J. BUSSELL *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 259-266 1982

Avail: NTIS HC A99/MF A01 CSCL 10A

The design and fabrication of composite blades for the WTS-4, a four-megawatt horizontal-axis wind turbine, is discussed. The blade consists of a two-cell, monolithic structure of filament-wound, fiberglass/epoxy composite. Filament winding is a low-cost process which can produce a blade with an aerodynamically efficient airfoil and planform with nonlinear twist to achieve high performance in terms of energy capture. Its retention provides a redundant attachment for long, durable life and safety. Advanced tooling concepts and as sophisticated computer control is used to achieve the unique filament-wound shape.

M G

N83-19244*# Budd Co., Philadelphia, Pa Technical Center **DESIGN AND EVALUATION OF LOW COST BLADES FOR LARGE WIND DRIVEN GENERATING SYSTEMS**

W. S. EGGERT *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 267-284 1982

(Contract DEN3-129)

Avail: NTIS HC A99/MF A01 CSCL 10A

The development and evaluation of a low cost blade concept based on the NASA-Lewis specifications is discussed. A blade structure was designed and construction methods and materials were selected. Complete blade tooling concepts, various technical and economic analysis, and evaluations of the blade design were performed. A comprehensive fatigue test program was conducted to provide data and to verify the design. A test specimen of the spar assembly, including the root end attachment, was fabricated. This is a full-scale specimen of the root end configuration, 20 ft long. A blade design for the Mod '0' system was completed.

M G

N83-19246*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio

STRUCTURAL FATIGUE TEST RESULTS FOR LARGE WIND TURBINE BLADE SECTIONS

J. R. FADDOUL and T. L. SULLIVAN *In its* Large Horizontal-Axis Wind Turbines p 303-328 1982 refs

Avail: NTIS HC A99/MF A01 CSCL 20K

In order to provide quantitative information on the operating life capabilities of wind turbine rotor blade concepts for root-end load transfer, a series of cantilever beam fatigue tests was conducted. Fatigue tests were conducted on a laminated wood blade with bonded steel studs, a low cost steel spar (utility pole) with a welded flange, a utility pole with additional root-end thickness provided by a swaged collar, fiberglass spars with both bonded and nonbonded fittings, and, finally, an aluminum blade with a bolted steel fitting (Lockheed Mod-0 blade). Photographs, data, and conclusions for each of these tests are presented. In addition, the aluminum blade test results are compared to field failure information; these results provide evidence that the cantilever beam type of fatigue test is a satisfactory method for obtaining qualitative data on blade life expectancy and for identifying structurally underdesigned areas (hot spots).

M G

N83-19247*# Michigan State Univ., East Lansing Div. of Engineering Research

WIND AND TURBINE CHARACTERISTICS NEEDED FOR INTEGRATION OF WIND TURBINE ARRAYS INTO A UTILITY SYSTEM

G L PARK *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 331-334 1982 refs
 Avail NTIS HC A99/MF A01 CSCL 10A

Wind data and wind turbine generator (WTG) performance characteristics are often available in a form inconvenient for use by utility planners and engineers. The steps used by utility planners are summarized and the type of wind and WTG data needed for integration of WTG arrays suggested. These included long term yearly velocity averages for preliminary site feasibility, hourly velocities on a 'wind season' basis for more detailed economic analysis and for reliability studies, worst-case velocity profiles for gusts, and various minute-to-hourly velocity profiles for estimating the effect of longer-term wind fluctuations on utility operations. Wind turbine data needed includes electrical properties of the generator, startup and shutdown characteristics, protection characteristics, pitch control response and control strategy, and electro-mechanical model for stability analysis. M.G.

N83-19248*# Pacific Northwest Lab., Richland, Wash
LONG-TERM ENERGY CAPTURE AND THE EFFECTS OF OPTIMIZING WIND TURBINE OPERATING STRATEGIES

A H MILLER and W J FORMICA *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 337-350 1982 refs
 (Contract DE-AC06-76RL-01830)

Avail NTIS HC A99/MF A01 CSCL 10A

Methods of increasing energy capture without affecting the turbine design were investigated. The emphasis was on optimizing the wind turbine operating strategy. The operating strategy embodies the startup and shutdown algorithm as well as the algorithm for determining when to yaw (rotate) the axis of the turbine more directly into the wind. Using data collected at a number of sites, the time-dependent simulation of a MOD-2 wind turbine using various, site-dependent operating strategies provided evidence that site-specific fine tuning can produce significant increases in long-term energy capture as well as reduce the number of start-stop cycles and yawing maneuvers, which may result in reduced fatigue and subsequent maintenance. M.G.

N83-19249*# JBF Scientific Corp., Wilmington, Mass.
INTEGRATION OF WIND TURBINE GENERATION (WTG) INTO UTILITY GENERATING SYSTEMS

T F MCCABE *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 353-355 1982
 Avail NTIS HC A99/MF A01 CSCL 10A

In order to obtain information required for the economical integration of wind turbine generation into utility systems, performance simulations of the MOD-2 turbine were conducted. The sensitivity of the utility-cost-of-generation to wind turbine performance models and the accuracy of wind velocity forecasts was analyzed. Four different simulation methods were used and the characteristics of each are discussed. M.G.

N83-19252*# Oregon State Univ., Corvallis Dept of Mechanical Engineering

ATMOSPHERIC TURBULENCE PARAMETERS FOR MODELING WIND TURBINE DYNAMICS

W E HOLLEY and R W THRESHER *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 391-409 1982 refs

(Contract DE-AT06-79ET-23144)

Avail NTIS HC A99/MF A01 CSCL 04B

A model which can be used to predict the response of wind turbines to atmospheric turbulence is given. The model was developed using linearized aerodynamics for a three-bladed rotor and accounts for three turbulent velocity components as well as velocity gradients across the rotor disk. Typical response power spectral densities are shown. The system response depends

critically on three wind and turbulence parameters, and models are presented to predict desired response statistics. An equation error method, which can be used to estimate the required parameters from field data, is also presented. R.J.F.

N83-19253*# Pacific Northwest Lab., Richland, Wash
INHERENT UNCERTAINTIES IN METEOROLOGICAL PARAMETERS FOR WIND TURBINE DESIGN

J C. DORAN *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 411-426 1982 refs
 (Contract DE-AC06-76RL-01830)

Avail: NTIS HC A99/MF A01 CSCL 04B

Major difficulties associated with meteorological measurements such as the inability to duplicate the experimental conditions from one day to the next are discussed. This lack of consistency is compounded by the stochastic nature of many of the meteorological variables of interest. Moreover, simple relationships derived in one location may be significantly altered by topographical or synoptic differences encountered at another. The effect of such factors is a degree of inherent uncertainty if an attempt is made to describe the atmosphere in terms of universal laws. Some of these uncertainties and their causes are examined, examples are presented and some implications for wind turbine design are suggested. R.J.F.

N83-19254*# Pacific Northwest Lab., Richland, Wash
Meteorological Office

POTENTIAL ERRORS IN USING ONE ANEMOMETER TO CHARACTERIZE THE WIND POWER OVER AN ENTIRE ROTOR DISK

R L. SIMON *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 427-443 1982 refs
 Avail: NTIS HC A99/MF A01 CSCL 04B

Wind data collected at four levels on a 90-m tower in a prospective wind farm area are used to evaluate how well the 10-m wind speed data with and without intermittent vertical profile measurements compare with the 90-m tower data. If a standard, or even predictable, wind speed profile existed, there would be no need for a large, expensive tower. This cost differential becomes even more significant if several towers are needed to study a prospective wind farm. R.J.F.

N83-19255*# National Aeronautics and Space Administration
 Lewis Research Center, Cleveland, Ohio.

PERFORMANCE AND LOAD DATA FROM MOD-0A AND MOD-1 WIND TURBINE GENERATORS

D A SPERA and D C JANETZKE *In its* Large Horizontal-Axis Wind Turbines p 447-468 1982 refs

Avail NTIS HC A99/MF A01 CSCL 10A

Experimental data, together with supporting analysis, are presented on the power conversion performance and blade loading of large, horizontal-axis wind turbines tested at electric utility sites in the U.S. Four turbine rotor configurations, from 28 to 61 meters in diameter, and data from five test sites are included. Performance data are presented in the form of graphs of power and system efficiency versus free-stream wind speed. Deviations from theoretical performance are analyzed statistically. Power conversion efficiency averaged 0.34 for all tests combined, compared with 0.31 predicted. Round blade tips appeared to improve performance significantly. Cyclic blade loads were normalized to develop load factors which can be used in the design of rotors with rigid hubs. Author

N83-19256*# National Aeronautics and Space Administration.
 Lewis Research Center, Cleveland, Ohio

OPERATING EXPERIENCE WITH FOUR 200 KW MOD-0A WIND TURBINE GENERATORS

A G BIRCHENOUGH, A L SAUNDERS, T W NYLAND, and R K SHALTENS *In its* Large Horizontal-Axis Wind Turbines p 469-487 1982 refs

Avail NTIS HC A99/MF A01 CSCL 10A

The windpowered generator, Mod-0A, and its advantages and disadvantages, particularly as it affects reliability, are discussed.

05 ENERGY CONVERSION

The machine performance with regard to power availability and power output is discussed R.J.F.

N83-19257*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
EXPERIENCE AND ASSESSMENT OF THE DOE/NASA MOD-1 2000 KW WIND TURBINE GENERATOR AT BOONE, NORTH CAROLINA

J. L. COLLINS, R. K. SHALTENS, R. H. POOR, and R. S. BARTON *In its* Large Horizontal-Axis Wind Turbines p 491-571 1982 refs Prepared in cooperation with General Electric Co. Avail NTIS HC A99/MF A01 CSCL 10B

The Mod 1 program objectives are defined. The Mod 1 wind turbine is described. In addition to the steel blade operated on the wind turbine, a composite blade was designed and manufactured. During the early phase of the manufacturing cycle of Mod 1A configuration was designed that identified concepts such as partial span control, a soft tower, and upwind teetered rotors that were incorporated in second and third generation industry designs. The Mod 1 electrical system performed as designed, with voltage flicker characteristics within acceptable utility limits R.J.F.

N83-19258*# Bendix Corp., Sylmar, Calif Environment and Technology Office.

DESCRIPTION OF THE 3 MW SWT-3 WIND TURBINE AT SAN GORGONIO PASS, CALIFORNIA

S. C. RYBAK *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 575-588 1982 Avail NTIS HC A99/MF A01 CSCL 10A

The SWT-3 wind turbine, a microprocessor controlled three bladed variable speed upwind machine with a 3MW rating that is presently operational and undergoing system testing, is discussed. The tower, a rigid triangular truss configuration, is rotated about its vertical axis to position the wind turbine into the prevailing wind. The blades rotate at variable speed in order to maintain an optimum 6 to 1 tip speed ratio between cut in and rated wind velocity, thereby maximizing power extraction from the wind. Rotor variable speed is implemented by the use of a hydrostatic transmission consisting of fourteen fixed displacement pumps operating in conjunction with eighteen variable displacement motors. Full blade pitch with on-off hydraulic actuation is used to maintain 3MW of output power R.J.F.

N83-19259*# WTG Energy Systems, Inc., Buffalo, NY
OPERATIONAL EXPERIENCE ON THE MP-200 SERIES COMMERCIAL WIND TURBINE GENERATORS

M. B. ROSE *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 593-605 1982 Avail NTIS HC A99/MF A01 CSCL 10A

The MP-200 wind turbine generator is described. The mechanical system, microprocessor controller, and display devices, are described. Also discussed are modifications to the prototype, operational experience, and MP-600 systems development R.J.F.

N83-19260*# Boeing Engineering and Construction Co., Seattle, Wash

DEVELOPMENT TESTS FOR THE 2.5 MEGAWATT MOD-2 WIND TURBINE GENERATOR

J. S. ANDREWS and J. M. BASKIN *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 611-633 1982 Avail NTIS HC A99/MF A01 CSCL 10A

The 2.5 megawatt MOD-2 wind turbine generator test program is discussed. The development of the 2.5 megawatt MOD-2 wind turbine generator included an extensive program of testing which encompassed verification of analytical procedures, component development, and integrated system verification. The test program was to assure achievement of the thirty year design operational life of the wind turbine system as well as to minimize costly design modifications which would otherwise have been required during on site system testing. Computer codes were modified, fatigue life of structure and dynamic components were verified, mechanical

and electrical component and subsystems were functionally checked and modified where necessary to meet system specifications, and measured dynamic responses of coupled systems confirmed analytical predictions R.J.F.

N83-19261*# Boeing Engineering and Construction Co., Tukwila, Wash

TEST STATUS AND EXPERIENCE WITH THE 7.5 MEGAWATT MOD-2 WIND TURBINE CLUSTER

R. A. AXELL and H. B. WOODY *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 637-650 1982 Avail NTIS HC A99/MF A01 CSCL 10A

The Mod-2 wind turbine cluster is described. The site preparation and construction activities are discussed, and preliminary test results, status, and plans are presented R.J.F.

N83-19262*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.

MOD-2 WIND TURBINE PROJECT ASSESSMENT AND CLUSTER TEST PLANS

L. H. GORDON *In its* Large Horizontal-Axis Wind Turbines p 653-673 1982 refs Avail NTIS HC A99/MF A01 CSCL 10A

An assessment of the Mod-2 Wind Turbine project is presented based on initial goals and present results. Specifically, the Mod-2 background, project flow, and a chronology of events/results leading to Mod-2 acceptance is presented. After checkout/acceptance of the three operating turbines, NASA/LeRC will continue management of a two year test program performed at the DOE Goodnoe Hills test site. This test program is expected to yield data necessary for the continued development and optimization of wind energy systems. These test activities, the implementation of, and the results to date are also presented Author

N83-19263*# Hamilton Standard, Windsor Locks, Conn Wind Energy Systems Div.

STATUS OF THE 4 MW WTS-4 WIND TURBINE

R. J. BUSSOLARI *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 675-684 1982 Avail NTIS HC A99/MF A01 CSCL 10A

The WTS-4 is a four-megawatt, horizontal-axis wind turbine presently being fabricated for the U.S. Department of Interior, Bureau of Reclamation, by United Technologies' Hamilton Standard division. This unit, called the System Verification Unit (SVU) will be installed at Medicine Bow, Wyoming, early next spring. The specifications, characteristics and features of the WTS-4 are discussed. The major components such as rotor, nacelle and tower are described and their status in the fabrication phase is presented Author

N83-19264*# Windfarms Ltd., San Francisco, Calif
THE 80 MEGAWATT WIND POWER PROJECT AT KAHUKU POINT, HAWAII

R. R. LAESSIG *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 689-706 1982 Avail NTIS HC A99/MF A01 CSCL 10A

Windfarms Ltd. is developing the two largest wind energy projects in the world. Designed to produce 80 megawatts at Kahuku Point, Hawaii and 350 megawatts in Solano County, California, these projects will be the prototypes for future large-scale wind energy installations throughout the world Author

N83-19265*# Little (Arthur D.), Inc., Cambridge, Mass
AN OVERVIEW OF LARGE WIND TURBINE TESTS BY ELECTRIC UTILITIES

W. A. VACHON and D. SCHIFF *In* NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 711-726 1982 refs Sponsored in part by EPRI Avail NTIS HC A99/MF A01 CSCL 10B

A summary of recent plants and experiences on current large wind turbine (WT) tests being conducted by electric utilities is provided. The test programs discussed do not include federal

research and development (R&D) programs, many of which are also being conducted in conjunction with electric utilities. The information presented is being assembled in a project, funded by the Electric Power Research Institute (EPRI), the objective of which is to provide electric utilities with timely summaries of test performance on key large wind turbines. A summary of key tests, test instrumentation, and recent results and plans is given. During the past year, many of the utility test programs initiated have encountered test difficulties that required specific WT design changes. However, test results to date continue to indicate that long-term machine performance and cost-effectiveness are achievable. Author

N83-19266*# Southern California Edison Co., Rosemead
UTILITY EXPERIENCE WITH TWO DEMONSTRATION WIND TURBINE GENERATORS

M C WEHREY /in NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 727-738 1982
 Avail NTIS HC A99/MF A01 CSCL 10B

Edison has committed 360 MW of nameplate generating capacity to wind energy by year 1990 in its long-range generation plan. To reach this goal the Company's wind energy program focuses on three areas: the continuous evaluation of the wind resource, the hands-on demonstration of wind turbine generators (WTG) and an association with wind park developers. Two demonstration WTGs have been installed and operated at Edison's Wind Energy Center near Palm Springs, California: a 3 MW horizontal axis Bendix/Schachle WTG and a 500 kW vertical axis Alcoa WTG. They are part of a one to two year test program during which the performance of the WTGs will be evaluated, their system operation and environmental impact will be assessed and the design criteria of future WTGs will be identified. Edison's experience with these two WTGs is summarized and the problems encountered with the operation of the two machines are discussed. B W

N83-19267*# Bureau of Reclamation, Denver, Colo.
WTS-4 SYSTEM VERIFICATION UNIT FOR WIND/HYDROELECTRIC INTEGRATION STUDY

A W WATTS /in NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 741-754 1982
 Avail NTIS HC A99/MF A01 CSCL 10A

The Bureau of Reclamation (Reclamation) initiated a study to investigate the concept of integrating 100 MW of wind energy from megawatt-size wind turbines with the Federal hydroelectric system. As a part of the study, one large wind turbine was purchased through the competitive bid process and is now being installed to serve as a system verification unit (SVU). Reclamation negotiated an agreement with NASA to provide technical management of the project for the design, fabrication, installation, testing, and initial operation. Hamilton Standard was awarded a contract to furnish and install its WTS-4 wind turbine rated at 4 MW at a site near Medicine Bow, Wyoming. The purposes for installing the SVU are to fully evaluate the wind/hydro integration concept, make technical evaluation of the hardware design, train personnel in the technology, evaluate operation and maintenance aspects, and evaluate associated environmental impacts. The SVU will be operational in June 1982. Data from the WTS-4 and from a second SVU, Boeing's MOD-2, will be used to prepare a final design for a 100-MW farm if Congress authorizes the project. Author

N83-19268*# Bonn Univ (West Germany)
INITIAL UTILITY EXPERIENCE WITH CLUSTER OF THREE MOD-2 WIND TURBINE SYSTEMS

D B SEELY, E J WARCHOL, N G BUTLER, and S CIRANNY /in NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 757-771 1982 refs
 Avail NTIS HC A99/MF A01 CSCL 10A

This paper describes the initial utility experiences of operating three MOD-2s during the Engineering Acceptance Testing. Electrical quantities of bus voltage, phase currents and power are initially being recorded to evaluate impacts to customers on the

69-kV subtransmission line during synchronization and operation of one or more WTSs. To date, effects on the system have been essentially undetectable. Measurements of television signal strengths were taken at an existing television remote pickup and relay station at the WTS site. Potential TV signal interference problems from the WTSs have been avoided by replacing the remote pickups with microwave repeater links for the four TV channels received from Portland, Oregon. Preliminary measurements of audible and sub-audible noise levels indicate that the upwind rotor, tubular tower design of the MOD-2 does not have the pulsing high intensity infrasound problems experienced by the MOD-1 machine at Boone, North Carolina. B.W.

N83-19269*# Oak Ridge National Lab., Tenn. Energy Div
A REVIEW OF UTILITY ISSUES FOR THE INTEGRATION OF WIND ELECTRIC GENERATORS

T. W. REDDOCH and P. R. BARNES /in NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 773-781 1982 refs
 (Contract W-7405-ENG-26)
 Avail: NTIS HC A99/MF A01 CSCL 10A

A review of issues and concerns of the electric utility industry for the integration of wind electric generation is offered. The issues have been categorized in three major areas: planning, operations, and dynamic interaction. Representative studies have been chosen for each area to illustrate problems and to alleviate some concerns. The emphasis of this paper is on individual large wind turbines (WTs) and WT arrays for deployment at the bulk level in a utility system. Author

N83-19271*# General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept.

CONCEPTUAL DESIGN OF THE 6 MW MOD-5A WIND TURBINE GENERATOR

R S BARTON and W C LUCAS /in NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 803-820 1982
 Avail. NTIS HC A99/MF A01 CSCL 10A

The General Electric Company, Advanced Energy Programs Department, is designing under DOE/NASA sponsorship the MOD-5A wind turbine system which must generate electricity for 3.75 cent/KWh (1980) or less. During the Conceptual Design Phase, completed in March, 1981, the MOD-5A WTG system size and features were established as a result of tradeoff and optimization studies driven by minimizing the system cost of energy (COE). This led to a 400' rotor diameter size. The MOD-5A system which resulted is defined in this paper along with the operational and environmental factors that drive various portions of the design. Development of weight and cost estimating relationships (WCER's) and their use in optimizing the MOD-5A are discussed. The results of major tradeoff studies are also presented. Subsystem COE contributions for the 100th unit are shown along with the method of computation. Detailed descriptions of the major subsystems are given, in order that the results of the various trade and optimization studies can be more readily visualized. Author

N83-19272*# Boeing Engineering and Construction Co., Seattle, Wash

CONCEPTUAL DESIGN OF THE 7 MEGAWATT MOD-5B WIND TURBINE GENERATOR

R R DOUGLAS /in NASA Lewis Research Center Large Horizontal-Axis Wind Turbines p 821-833 1982 refs
 Avail NTIS HC A99/MF A01 CSCL 10A

Similar to MOD-2, the MOD-5B wind turbine generator system is designed for the sole purpose of providing electrical power for distribution by a major utility network. The objectives of the MOD-2 and MOD-5B programs are essentially identical with one important exception; the cost-of-electricity (COE) target is reduced from 4 cent/Kwhr on MOD-2 to 3 cent/Kwhr on MOD-5B, based on mid 1977 dollars and large quantity production. The MOD-5B concept studies and eventual concept selection confirmed that the program COE targets could not only be achieved but substantially bettered. Starting from the established MOD-2 technology as a base, this achievement resulted from a combination of concept changes,

05 ENERGY CONVERSION

size changes, and design refinements. The result of this effort is a wind turbine system that can compete with conventional power generation over significant geographical areas, increasing commercial market potential by an order of magnitude. Author

N83-19273* # EIC, Inc., Newton, Mass.

DEVELOPMENT OF A HIGH CAPACITY TOROIDAL NI/CD CELL Final Report

G. L. HOLLECK, J. S. FOOS, J. W. AVERY, and V. FEIMAN
Jul 1981 114 p refs
(Contract NAS3-21274)
(NASA-CR-169945; NAS 1 26:169945) Avail: NTIS HC A06/MF A01 CSCL 10C

A nickel cadmium battery design which can offer better thermal management, higher energy density and much lower cost than the state-of-the-art is emphasized. A toroidal Ni/Cd cell concept is described. It was critically reviewed and used to develop two cell designs for practical implementation. One is a double swaged and the other a swaged welded configuration. S.L.

N83-19275# ECO, Inc., Buzzards Bay, Mass.

FUEL CELL ELECTROLYTE FOR PORTABLE ELECTRICAL GENERATING EQUIPMENT Final Technical Report, Mar. - Aug. 1982

F. WALSH and K. AYERS Aug. 1982 37 p refs
(Contract DAAK70-82-C-0042)
(AD-A121176) Avail: NTIS HC A03/MF A01 CSCL 10C

The goal of the research program was to synthesize and test a substitute electrolyte for phosphoric acid in primary fuel cells with the necessary physical, chemical and electrochemical stability to operate from room temperature to 150 C. This goal was successfully met and exceeded with a perfluorinated acid (hexafluorobutane tetrasulfonic) produced which operates over the temperature range of at least 0 to 150 C in hydrogen-oxygen fuel cells. In addition, ECO prepared and tested a second perfluorinated acid (hexafluoro-2, 3- butene disulfonic acid) which appears to have similar properties. The use of these new electrolytes in primary fuel cells is expected to significantly reduce start-up time, extend operational temperature range, and to minimize problems related to CO-poisoned fuels. GRA

N83-19278# Flow Research, Inc., Kent, Wash

DEVELOPMENT OF A QUIET STIRLING CYCLE MULTI-FUEL ENGINE FOR ELECTRIC POWER GENERATION Final Report, Feb. - Aug. 1982

J. E. MERCER, S. G. EMIGH, P. RIGGLE, O. L. TREMOULET, and M. A. WHITE Aug 1982 45 p
(Contract DAAK70-82-C-0046, DA PROJ. 1L1-62733-AH-20)
(AD-A121033; RTD-242) Avail: NTIS HC A03/MF A01 CSCL 10B

The work described in this report summarizes a six-month study to develop a lightweight, tactical electric power plant with a low level of aural, I R., and visual detectability, based on a Stirling engine. The conceptual design presented was analyzed and predicted to have power output qualities exceeding those specified by the Army for tactical generators. The unit promises to have maintenance and overhaul requirement characteristics superior to any generator system in current use. Author (GRA)

N83-19282# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst

OPEN-CYCLE SYSTEMS PERFORMANCE ANALYSIS PROGRAMMING GUIDE

D. A. OLSON Dec. 1981 189 p refs
(Contract DE-AC02-77CH-00178)
(DE82-005696; SERI/TR-631-1147) Avail: NTIS HC A09/MF A01

The Open-Cycle OTEC Systems Performance Analysis Program is an algorithm programmed on SERI's CDC Cyber 170/720 computer to predict the performance of a Claude-cycle, open-cycle OTEC plant. The algorithm models the Claude-cycle system as consisting of an evaporator, a turbine, a condenser, deaerators, a condenser gas exhaust, a cold water pipe and cold and warm

seawater pumps. Each component is a separate subroutine in the main program. A description is given of how to write FORTRAN subroutines to fit into the main program for the components of the OTEC plant. An explanation is provided of how to use the algorithm. The main program and existing component subroutines are described. Appropriate common blocks and input and output variables are listed. Preprogrammed thermodynamic property functions for steam, fresh water, and seawater are described. DOE

N83-19309# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Advanced Energy Storage Systems Storage Vehicles Panel

A COMPARISON OF ALTERNATIVE ENERGY STORAGE SYSTEMS FOR AUTOMOBILES

1982 36 p refs
(Contract DE-AT02-76CH-93012)
(PB82-249954) Avail: NTIS HC A03/MF A01 CSCL 10C

The performance potentials of primary batteries, fuel cells, and flywheel-transmission systems in comparison with secondary batteries as alternates to conventional internal combustion engine automobile power systems are discussed. A number of areas of research that are recommended for attention as part of a well-rounded investigation of alternatives are outlined. GRA

N83-19398# Pacific Northwest Lab., Richland, Wash

METEOROLOGICAL FIELD MEASUREMENTS AT POTENTIAL AND ACTUAL WIND-TURBINE SITES

D. S. RENNE, W. F. SANDUSKY, and D. L. HADLEY Sep 1982 70 p refs
(Contract DE-AC06-76RL-01830)
(DE83-001493; PNL-4431) Avail: NTIS HC A04/MF A01

A meteorological measurement program conducted at a number of locations around the United States for the purpose of site evaluation for wind energy utilization is presented. The evolution of the measurement program from its inception in 1976 to the present day is discussed. Some of the major accomplishments and areas for improvement are outlined. Conclusions on research using data from this program are presented. DOE

N83-19595# Offshore Power Systems, Jacksonville, Fla

CONCEPTUAL DESIGN STUDY. STANDARD FLOATING NUCLEAR POWER PLANT ON INSHORE SITE AND MODIFIED FLOATING NUCLEAR POWER PLANT ON UPRIVER SITE Report, Oct. 1981

Feb. 1982 156 p refs
(Contract DE-AC04-76DP-00789)
(DE82-007916; ALO-1000-VOL-1) Avail: NTIS HC A08/MF A01

Both plants/designs are technically feasible. Both compare favorably with conventional nuclear plants with respect to licensability, quality of construction, reliability of operation, and safety. Both offer considerable reductions in construction schedule over conventional nuclear plants. It was estimated that if project durations were reduced by three years the cost of a 1100 MWe nuclear unit could be decreased by \$260 million to \$450 million. The allowance for funds during construction (AFDC) was estimated to be \$929 million for a 1260 MWe nuclear plant with a commercial operation date in 1992. Reducing the schedule from 12 to 9 years, a reduction of 25%, implies a savings in AFDC alone of approximately \$230 million. GRA

N83-19615# California Univ., Livermore. Lawrence Livermore Lab.

FUSION TECHNOLOGY STATUS AND REQUIREMENTS

K. I. THOMASSEN 26 Jan. 1982 15 p Presented at the 9th Energy Technol Conf., Washington, D. C., 16-18 Feb 1982
(Contract W-7405-ENG-48)
(DE82-010754; UCRL-87116, CONF-820217-1) Avail: NTIS HC A02/MF A01

Fusion technologies are grouped into nuclear (first wall components, blankets, fuel handling, shielding), plasma production (magnets, cryogenics, radio frequency, neutral beam, plasma fuelling, power supplies, energy storage, plasma direct recovery,

vacuum), and systems (instrumentation, control, safety, environmental, maintenance, handling) The status of each of these technologies is discussed for major existing test facilities. The operating characteristics are listed for a fusion engineering device proposed to demonstrate net electric power production and the breeding of its own fuel A.R.H

N83-20054# United Technologies Research Center, East Hartford, Conn.

FLOW DISTRIBUTION CONTROL CHARACTERISTICS IN MARINE GAS TURBINE WASTE-HEAT RECOVERY SYSTEM. PHASE 2: FLOW DISTRIBUTION CONTROL IN WASTE-HEAT STEAM GENERATORS Annual Technical Report, Jul. 1981 - Jul. 1982

S C KUO and H. T SHU Jul. 1982 138 p refs
(Contract N00014-80-C-0476, NR PROJ 097-411)
(AD-A119310, UTRC-R82-955750-4) Avail: NTIS HC A07/MF A01 CSCL 13J

The effect of flow distribution control on the design and performance of marine gas turbine waste heat steam generators was investigated Major design requirements and critical problems associated with a waste heat steam generator were reviewed, and an existing two dimensional heat exchanger model based on the compact heat exchanger design criteria and the relaxation approach was modified and updated to estimate the waste heat steam generator performance at any inlet gas flow distribution Performance estimates were made of the steam generator using uniform velocity distribution, and also actual flow distribution data available (at the diffuser inlet) with and without flow distribution controls, all at design and off design operating conditions of the gas turbine engine Results indicate that the exit steam temperatures of the baseline waste heat steam generator with and without flow distribution controls would be 725 F and 450 F, respectively, for a constant design flow ratio of 7.9 lb/sec, and for a constant exit temperature of 700 F, the water flow rates would be 8.1 lb/sec and 6.6 lb/sec, respectively GRA

N83-20114# California Univ., Livermore. Lawrence Livermore Lab

LASER-PLASMA INTERACTION EXPERIMENTS AT LASER WAVELENGTHS OF 1.064 MICRON, 0.532 MICRON AND 0.355 MICRON

E M CAMPBELL, W. C. MEAD, R E TURNER, D. W. PHILLION, C. E. MAX, F. ZE, K. G. ESTABROOK, G. TIRSELL, B. PRUETT, and V C RUPERT 1982 29 p refs Presented at the US/Japan Seminar on Theory and Appl. of Multiple Ionized Plasmas Produced by Laser and Particle Beams, Nara, Japan, 2 May 1982 (Contract W-7405-ENG-48)
(DE82-013992; UCRL-87219, CONF-820528-5) Avail: NTIS HC A03/MF A01

Experiments at all three wavelengths included the following: target absorption, stimulated Brillouin scattering, suprathermal electron production, observation of harmonic and half harmonic emission from the plasma as a signature of parametric processes such as 2 omega/sub pe/ and simulated Raman scattering Comparisons of detailed hydro code and plasma simulation results were presented DOE

N83-20161# Southwest Research Inst., San Antonio, Tex.
FUEL PROPERTY EFFECTS ON DIESEL ENGINE AND GAS TURBINE COMBUSTOR PERFORMANCE Interim Report, Oct. 1980 - Dec. 1981

A. F. MONTEMAYOR, D. W. NAEGELI, L. G. DODGE, E. C. OWENS, and J. N. BOWDEN Nov 1981 82 p refs
(Contract DAAK70-80-C-0001; DAAK70-82-C-0001, DA PROJ. 1L7-62733-AH-20)
(AD-A120879, SWRI-6800-120/1; AFLRL-149) Avail: NTIS HC A05/MF A01 CSCL 21B

In this test program, four military engines and a gas turbine combustor were run to determine the effects of fuel properties on combustion performance During this program, 18 test fuels were prepared with properties extending beyond the range of the specifications of diesel fuels Diesel engine performance data were

analyzed statistically, and regression equations were obtained for each engine expressing load in terms of speed, energy input, cetane number, kinematic viscosity, 10 percent boiling point, and aromatic content Combustion performance measurements in the T-63 gas turbine combustor included flame radiation, exhaust smoke, gaseous emissions (THC, CO and NOx), combustion efficiency, and ignition properties The atomizing characteristics of the test fuels were examined with a particle sizing system based on forward-angle diffraction, and the results were correlated with the ignition properties of the fuels Flame radiation and exhaust smoke were correlated with H/C ratio of the fuel Viscosity and end point work were used as correlating parameters for THC and CO emissions, and combustion efficiency Significance of the results was discussed, and recommendations for further testing was presented GRA

N83-20372# Committee on Science and Technology (U. S. House)

FISCAL YEAR 1983 DEPARTMENT OF ENERGY BUDGET REVIEW. MAGNETIC FUSION ENERGY. VOLUME 5

Washington GPO 1982 564 p Hearings before the Subcomm on Energy Res. and Prod. of the Comm. on Sci. and Technol., 97th Congr., 2d Sess., 23, 24 Mar. 1982
(GPO-98-550) Avail: Subcommittee on Energy Research and Production

The DOE magnetic fusion energy program is considered. Budget testimony is provided. Author

N83-20403# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

PERFORMANCE AND STABILITY OF THE MIST-LIFT PROCESS FOR OPEN-CYCLE OTEC

R. L. DAVENPORT Feb 1982 128 p refs
(Contract DE-AC02-77CH-00178)
(DE82-010881; SERI/TR-252-1422) Avail: NTIS HC A07/MF A01

In the mist flow proposal for open-cycle ocean thermal energy conversion (OTEC), the thermal energy of the warm water is converted into gravitational potential energy causing the water to flow vertically upward as a low-pressure two-phase flow of small droplets in water vapor The gravitational energy is then converted to electrical energy using a standard hydraulic turbine. The results of SERI's analytical studies of the mist lift process are summarized. Several computer models have been developed: a single-drop-size steady-state (SDS) model; a multiple-drop-size steady-state model including drop coalescence and drop breakup (MDS-B model), and a single-drop-size transient (SDT) model. Results from the multiple-drop-size model indicate that drop growth is rapid up to a mean diameter of about 0.5 mm, and that the drop size spectrum changes little thereafter. Parametric studies performed of the mist lift process is large, and showed the effects of design parameters on performance DOE

N83-20413# AeroVironment, Inc., Pasadena, Calif.
DEFINITION OF COST-EFFECTIVE RIVER-TURBINE DESIGNS Final Report, 30 Sep. 1980 - 31 Dec. 1981

R. L. RADKEY and B. D. HIBBS Dec. 1981 189 p refs
(Contract DE-FC07-80ID-12204)
(DE82-010972, AV-FR-81/595) Avail: NTIS HC A09/MF A01

Low pressure run-of-the-river turbines are discussed. These river turbine units will operate on the equivalent of less than 0.2 m (7 in.) of head, and in a river with a reasonable current resource, the units are estimated to reduce cost-effective electricity Two system concepts were evaluated: a ducted turbine system, and a free-rotor system The ducted turbine uses an augments duct to increase volume flow through the turbine rotor, and the free-rotor system is essentially an underwater windmill The program consisted of the following tasks: define river current resources; design ducted and free-rotor systems and develop performance estimates; determine system cost estimates and conduct an economic analysis, and conduct a model test program to substantiate duct augmentation. The overall conclusion is that both ducted and

05 ENERGY CONVERSION

free-rotor turbine system can produce cost-effective electricity
DOE

N83-20421# Princeton Univ., N J Dept of Mechanical and Aerospace Engineering

THE PLASMADYNAMICS AND IONIZATION KINETICS OF THERMIONIC ENERGY CONVERSION

J L LAWLESS, JR. and S H LAM Feb 1982 198 p refs
(Contract DE-AC02-76ET-15352)
(DE82-012938, DOE/ET-15352/T1; COO-2533-13) Avail NTIS HC A09/MF A01

The reduction of the plasma arc/drop, thermionic energy conversion was studied. The plasmadynamic and ionization recombination theories were simplified. These are applied to a scheme proposed, using laser irradiation to enhance the ionization kinetics of the thermionic plasma and thereby reduce the arc drop. It is possible to generate the required laser light from a thermionic type cesium plasma. It is shown that large laser ionization enhancements can occur and that collisional cesium recombination lasing is expected. A numerical method is developed to solve the thermionic plasma dynamics. A finite difference computer program is constructed to combine the analysis of ionization recombination kinetics with the plasma dynamics of thermionic conversion. It is capable of solving for both unsteady and steady thermionic converter behavior including possible laser ionization enhancement or atomic recombination lasing. In this proposed scheme, laser radiation impinging on a thermionic plasma enhances the ionization process thereby raising the plasma density and reducing the plasma arc drop. A source for such radiation may possibly be a cesium recombination laser operating in a different thermionic converter. The energy efficiency of this process is discussed
DOE

N83-20422# California Univ., Berkeley. Lawrence Berkeley Lab.

PROSPECTS FOR THE DEVELOPMENT OF NON-NOBLE METAL CATALYSTS FOR HYDROGEN-AIR FUEL CELLS Final Report

P. N ROSS, JR. and F T WAGNER Mar 1982 65 p refs
(Contract W-7405-ENG-48)
(DE82-013875; LBL-14192) Avail NTIS HC A04/MF A01

The purpose of this report is to review the literature on the electrocatalysis of hydrogen-air fuel cells in order to determine the prospects for replacing Pt in transportation fuel cells and to suggest research directions which might lead to the development of non-Pt (more generally, non-noble metal) catalysts. The study is restricted to catalysts for the air electrode with an emphasis primarily on acid electrolyte fuel cells using reformed hydrocarbon fuels (e.g., methanol). The classes of materials which have been reviewed include transition metal oxides, sulfides, selenides, the refractory interstitial compounds (e.g., carbides, nitrides, silicides and borides of Ti, W, etc.), and aromatic macrocyclic porphyrins and phthalocyanines. Quantitative comparison of all classes of materials was not possible due to that variety of methods employed to measure catalytic activity and combinations of temperature and electrolyte used. A procedure was derived whereby a semi-quantitative (order of magnitude) comparison was possible by normalizing the reported activity to that for Pt in comparable physical form (foils, wires, powders, dispersed, etc.) at the same temperature in the same electrolyte.
DOE

N83-20437# United Technologies Corp., South Windsor, Conn Power Systems Div

ON-SITE FUEL CELL POWER PLANT TECHNOLOGY DEVELOPMENT PROGRAM Annual Report, Jan. - Dec. 1981

A P MIENTEK Jul. 1982 138 p
(PB83-102335, GRI-80/0162; FCR-4111A) Avail. NTIS HC A07/MF A01 CSCL 10B

Fuel cell power plant designs, specifications and technologies were evaluated to define a power plant approach having the potential for meeting initial on-site commercial service market requirements and costs. An initial commercial market segment was defined for a range of power plant sizes. A preliminary power plant specification and model power plant system were selected as a baseline for further technology development and cost reduction

efforts in subsequent program phases. Inverter designs with advanced individual commutation circuitry were defined and evaluated. Sulphur-tolerant reformer catalysts were tested and cell performance on sulphur-bearing fuels was determined. Electrode substrates having greater electrolyte storage capacity and intercell cooler concepts having improved corrosion resistance were developed
GRA

N83-20770# California Univ., Livermore Lawrence Livermore Lab

PHYSICS OF MIRROR SYSTEMS

R F POST May 1982 52 p refs Presented at the Intern. Conf. on Plasma Phys., Goteborg, 7 Jun. 1982
(Contract W-7405-ENG-48)
(DE82-015908; UCRL-87677, CONF-820618-4) Avail NTIS HC A04/MF A01

In recent years the emphasis in research on the magnetic mirror approach to fusion has been shifted to address what are essentially economically-motivated issues. The introduction of the tandem mirror idea solved in principal the problem of low Q (low fusion power gain) of mirror-based fusion systems. In order to optimize the tandem mirror idea from an economic standpoint, some important improvements have been suggested. These improvements include the thermal barrier idea of Baldwin and Logan and the axicell concept of Kesner. These new modifications introduce some special physics considerations. Among these are (1) the MHD stability properties of high energy electron components in the end cells; (2) the optimization of end-cell magnetic field configurations with the objective of minimizing equilibrium parallel currents, and (3) the suppression of microstabilities by use of sloshing ion distributions.
DOE

N83-20781# Artec Associates, Inc., Hayward, Calif
HIGH POWER PULSED PLASMA MHD EXPERIMENTS Annual Report, 1 Jan. 1981 - 30 Sep. 1982

D. W. BAUM, S. P. GILL, W. L. SHIMMIN, and J. D. WATSON
30 Sep. 1982 47 p refs
(Contract N00014-81-C-0045)
(AD-A120526, AR-165) Avail. NTIS HC A03/MF A01 CSCL 201

Results of high power pulsed plasma MHD experiments are reported. An explosively driven plasma source is used to drive a Faraday mode MHD generator with an externally applied B-field of several tesla. The highest power achieved was 6 gigawatts in a 140 kJ electrical pulse delivered to a resistive load. The experimentally observed scaling relationships of power with applied B-field and electrode area are also presented.
GRA

N83-20782# Artec Associates, Inc., Hayward, Calif
HIGH POWER PULSED PLASMA MHD EXPERIMENTS Annual Report, 1 Jan. 1981 - 30 Sep. 1982

D W BAUM, S. P. GILL, W L SHIMMIN, and J D. WATSON
20 Sep 1982 48 p refs
(Contract N00014-81-C-0045)
(AD-A120526, AR-165) Avail NTIS HC A03/MF A01 CSCL 201

Results of high power pulsed plasma MHD experiments are reported. An explosively driven plasma source is used to drive a Faraday mode MHD generator with an externally applied B-field of several tesla. The highest power achieved was 6 gigawatts in a 140 kJ electrical pulse delivered to a resistive load. The experimentally observed scaling relationships of power with applied B-field and electrode area are also presented.
Author (GRA)

N83-21006# European Space Agency, Paris (France)
FOURTH ESTEC SPACECRAFT POWER-CONDITIONING SEMINAR

B. BATTRICK, comp. and E. ROLFE, comp Sep 1982 192 p refs Proc of Intern Sem., Noordwijk, Netherlands, 9-11 Nov 1982. Partly in ENGLISH and FRENCH
(ESA-SP-186, ISSN-0379-6566) Avail NTIS HC A09/MF A01

Payload and system interfaces; original regulator/converter concepts, application of new techniques/technologies, power

conditioning, energy storage and auxiliary electronics, and analysis and modelling are discussed.

N83-21021# Engins Matra, Toulouse (France).

ENERGY GENERATING AND STORING METHOD FOR SPACE APPLICATION [METHODE DE GENERATION ET DE STOCKAGE D'ENERGIE POUR L'APPLICATION SPATIALE]

Y DUBOIS / In ESA 4th ESTEC Spacecraft Power-Conditioning Seminar p 103-114 Sep 1982 refs In FRENCH
Avail NTIS HC A09/MF A01

The state of the art of lithium batteries is described as well as a system for energy storage based on the use of a fuel cell plus an electrolyzer. Increased performance of lithium batteries gives this type of energy source numerous potential applications in the space domain. They constitute an irreplaceable energy source for interplanetary probes and can permit a substantial gain in mass for launch vehicles. Important progress realized with fuel cells makes the fuel cell-electrolyzer system particularly attractive for low orbit applications. The performance of the battery plus electrolyzer is analyzed and used to show the superiority of this system with respect to a system with Ni/Cd batteries.

Transl. by A R H

N83-21056*# Case Western Reserve Univ., Cleveland, Ohio
Dept of Chemical Engineering

THE ELECTROCHEMICAL FLUORINATION OF POLYMERIC MATERIALS FOR HIGH ENERGY DENSITY AQUEOUS AND NON-AQUEOUS BATTERY AND FUEL CELL SEPARATORS Final Report

C C LIU Feb. 1983 103 p refs

(Contract NAG3-66)

(NASA-CR-167961, NAS 1 26 167961) Avail: NTIS HC A06/MF A01 CSCL 07D

A computerized system was established and the electrochemical fluorination of trichloroethylene, polyacrylic acid and polyvinyl alcohol in anhydrous hydrogen fluoride was attempted. Both solid substrates as well as membranes were used. Some difficulties were found in handling and analyzing the solid substrates and membranes. Further studies are needed in this area. A microprocessor aided electrochemical fluorination system capable of obtaining highly reproducible experimental results was established.

Author

N83-21075# Oak Ridge National Lab., Tenn

ELECTROMIGRATIONAL COMPOSITION GRADIENTS IN MOLTEN CARBONATES: A REVIEW

J BRAUNSTEIN and C E VALLET Oct. 1982 63 p refs

(Contract W-7405-ENG-26)

(DE83-002593, ORNL/TM-8501) Avail: NTIS HC A04/MF A01

Computations and measurements are reviewed pertaining to studies of current induced separation of Li_2CO_3 and K_2CO_3 in molten carbonate fuel cells. Such separation is to be expected if the electrical mobilities of $\text{Li}(\cdot)$ and $\text{K}(\cdot)$ relative to carbonate are unequal. Measurements of emf relaxation following a current step are compared with predicted relaxations based on a mass transport model as well as with measured relaxation of thermoelectric temperature gradients, Seebeck potentials, kinetics of electron transfer and other possible contributions to the observed relaxation. The magnitudes and time scales of the relaxations other than that predicted from the mass transport model cannot account for the observed emf relaxation. This, together with preliminary measurements of electrical mobilities and electrolyte composition changes reported at the electrodes of molten carbonate fuel cells, suggest that an electromigrational separation is significant (although smaller than that demonstrated for Li/LiCl-KCl/FeS batteries). A summary of information needed to quantitatively characterize this effect is presented.

DOE

N83-21246# Stanford Univ., Calif High Temperature Gasdynamics Lab.

HALL-FIELD LIMITATIONS IN MDH GENERATORS

W. L HERMINA Apr 1982 327 p refs

(Contract DE-AC01-80ET-15611, EX-76-C-01-2341)

(DE83-001149, HTGL-229) Avail: NTIS HC A15/MF A01

An experimental and theoretical study of Hall field limitations in clean fuel combustion-driven MHD generators has been completed. The purpose of this study has been to understand the processes leading up to both insulator and plasma initiated interelectrode breakdown. The present work has been most concerned with insulator initiated breakdown as a result of the lower breakdown thresholds for this breakdown mode as compared to the plasma initiated breakdown mode. The experimental work consisted of two sets of experiments. In the first set, several interelectrode insulator cooling techniques were studied for the purpose of extending the insulator initiated breakdown threshold to higher voltages. The second set of experiments dealt with the dependence of the Hall field behavior on generator parameters such as magnetic field, insulator size and transverse current density. The theoretical work consisted of developing a computer program to model the processes leading up to both insulator and plasma initiated breakdown.

DOE

N83-21247# Wisconsin Univ., Madison

ASSESSMENT OF RESEARCH DIRECTIONS FOR HIGH-VOLTAGE DIRECT-CURRENT POWER SYSTEMS Final Report

W. F LONG Sep 1982 57 p refs

(Contract DE-AC02-78ET-29185)

(DE83-001118, DOE/ET-29185/21) Avail: NTIS HC A04/MF A01

The identification of hardware developments and system applications which exemplify cost and operational advantages of integrated ac/dc power systems is discussed. The three principal tasks undertaken were assessment of equipment developments, quantification of operational advantages, and interaction with system planners. The dissemination of information about high voltage direct current (HVDC) is a critical factor in fostering an understanding of this important adjunct to ac power transmission.

DOE

N83-21366# Solar Turbines International, San Diego, Calif.

CENTAUR GAS-TURBINE MODIFICATION AND DEVELOPMENT FOR SOLAR-FOSSIL HYBRID OPERATION Final Report

P. B. ROBERTS and A. J. KUBASCO Sep 1982 82 p refs

(Contract EPRI PROJ. 1270-1)

(DE83-900192; EPRI-AP-2550) Avail: NTIS HC A05/MF A01

Conceptual designs of the hardware and systems modifications required to operate the Centaur recuperative gas turbine generator set in a solar fossil hybrid mode were developed. The combustion and control systems were defined as the major technology voids and a single shaft Centaur generator set with a parallel trim combustor selected as the preferred system configuration. A bench scale combustor development program was conducted to generate the design and performance data necessary for preliminary definition of the full size trim combustor. A bench scale trim combustor was developed with the turndown capabilities necessary for the hybrid solar fossil system.

DOE

N83-21508*# Massachusetts Inst. of Tech., Cambridge

STABILITY ANALYSIS OF FLEXIBLE WIND TURBINE BLADES USING FINITE ELEMENT METHOD Final Report

A. KAMOULAKOS Aug 1982 156 p refs

(Contract NSG-3303, DE-AI01-76ET-20320)

(NASA-CR-168107, DOE/NASA/3303-2, NAS 1 26-168107,

MIT-ARSL-TR-197-3) Avail: NTIS HC A08/MF A01 CSCL 10A

Static vibration and flutter analysis of a straight elastic axis blade was performed based on a finite element method solution. The total potential energy functional was formulated according to linear beam theory. The inertia and aerodynamic loads were formulated according to the blade absolute acceleration and absolute velocity vectors. In vibration analysis, the direction of

05 ENERGY CONVERSION

motion of the blade during the first out-of-plane and first in-plane modes was examined; numerical results involve NASA/DOE Mod-0, McCauley propeller, north wind turbine and flat plate behavior. In flutter analysis, comparison cases were examined involving several references. Vibration analysis of a nonstraight elastic axis blade based on a finite element method solution was performed in a similar manner with the straight elastic axis blade, since it was recognized that a curved blade can be approximated by an assembly of a sufficient number of straight blade elements at different inclinations with respect to common system of axes. Numerical results involve comparison between the behavior of a straight and a curved cantilever beam during the lowest two in-plane and out-of-plane modes. Author

N83-21509*# Massachusetts Inst of Tech, Cambridge
Aeroelastic and Structures Research Lab
**SIMPLIFIED AEROELASTIC MODELING OF HORIZONTAL AXIS
WIND TURBINES Final Report**

J. H. WENDELL Sep 1982 231 p refs
(Contract NSG-3303, DE-AI01-76ET-20320)
(NASA-CR-168109, DOE/NASA/3303-3, NAS 1.26.168109;
MIT-ASRL-TR-197-4) Avail. NTIS HC A11/MF A01 CSDL 10A

Certain aspects of the aeroelastic modeling and behavior of the horizontal axis wind turbine (HAWT) are examined. Two simple three degree of freedom models are described in this report, and tools are developed which allow other simple models to be derived. The first simple model developed is an equivalent hinge model to study the flap-lag-torsion aeroelastic stability of an isolated rotor blade. The model includes nonlinear effects, precone, and noncoincident elastic axis, center of gravity, and aerodynamic center. A stability study is presented which examines the influence of key parameters on aeroelastic stability. Next, two general tools are developed to study the aeroelastic stability and response of a teetering rotor coupled to a flexible tower. The first of these tools is an aeroelastic model of a two-bladed rotor on a general flexible support. The second general tool is a harmonic balance solution method for the resulting second order system with periodic coefficients. The second simple model developed is a rotor-tower model which serves to demonstrate the general tools. This model includes nacelle yawing, nacelle pitching, and rotor teetering. Transient response time histories are calculated and compared to a similar model in the literature. Agreement between the two is very good, especially considering how few harmonics are used. Finally, a stability study is presented which examines the effects of support stiffness and damping, inflow angle, and precone.

Author

N83-21511*# Jet Propulsion Lab., California Inst of Tech,
Pasadena
**APPLICATIONS GUIDE FOR WASTE HEAT RECOVERY Final
Report, May - Dec. 1982**

P. I. MOYNIHAN Jan 1983 81 p refs
(Contract MIPR-N-82-52)
(NASA-CR-170121; JPL-PUBL-83-7, NAS 1.26.170121;
DEB-TR-82-02) Avail. NTIS HC A05/MF A01 CSDL 10B

The state-of-the-art of commercially available organic Rankine cycle (ORC) hardware from a literature search and industry survey is assessed. Engineering criteria for applying ORC technology are established, and a set of nomograms to enable the rapid sizing of the equipment is presented. A comparison of an ORC system with conventional heat recovery techniques can be made with a nomogram developed for a recuperative heat exchanger. A graphical technique for evaluating the economic aspects of an ORC system and conventional heat recovery method is discussed; also included is a description of anticipated future trends in organic Rankine cycle R&D. Author

N83-21526# Sandia Labs, Albuquerque, N Mex Vibration and
Modal Testing Div

MODAL TESTING OF A ROTATING WIND TURBINE

T. G. CARNE and A. R. NORD Nov 1982 19 p refs
(Contract DE-AC04-76DP-00789)

(DE83-003630; SAND-82-0631) Avail. NTIS HC A02/MF A01

A testing technique was developed to measure the modes of vibration of a rotating vertical-axis wind turbine. This technique was applied to the Sandia Two-Meter Turbine, where the changes in individual modal frequencies as a function of the rotational speed were tracked from 0 rpm (parked) to 600 rpm. During rotational testing, the structural response was measured using a combination of strain gages and accelerometers, passing the signals through slip rings. Excitation of the turbine structure was provided by a scheme which suddenly released a pretensioned cable, thus plucking the turbine as it was rotating at a set speed. In addition to calculating the real modes of the parked turbine, the modes of the rotating turbine were also determined at several rotational speeds. The modes of the rotating system proved to be complex due to centrifugal and Coriolis effects. The modal data for the parked turbine were used to update a finite-element model. Also, the measured modal parameters for the rotating turbine were compared to the analytical results, thus verifying the analytical procedures used to incorporate the effects of the rotating coordinate system. DOE

N83-21544# Engineering and Economics Research, Inc., Vienna,
Va.

**INTEGRATION OF HYDROTHERMAL-ENERGY ECONOMICS:
RELATED QUANTITATIVE STUDIES**

Aug 1982 127 p refs
(Contract DE-AC07-81ID-12314)
(DE83-001407, DOE/ID-12314/T1) Avail. NTIS HC A07/MF
A01

A comparison of ten models for computing the cost of hydrothermal energy is presented. This comparison involved a detailed examination of a number of technical and economic parameters of the various quantitative models with the objective of identifying the most important parameters in the context of accurate estimates of cost of hydrothermal energy. Important features of various models, such as focus of study, applications, marked sectors covered, methodology, input data requirements, and output are compared in the document. A detailed sensitivity analysis of all the important engineering and economic parameters is carried out to determine the effect of non-consideration of individual parameters. DOE

N83-21548# Washington Univ Technology Associates, Inc., St.
Louis, Mo

**THE INVESTIGATION OF PASSIVE BLADE CYCLIC PITCH
VARIATION USING AN AUTOMATIC YAW CONTROL SYSTEM
Final Report**

K. H. HOHENEMSER and A. H. P. SWIFT Aug 1982 92 p
refs
(Contract DE-AC02-77CH-00178, EG-77-C-01-4042)
(DE83-000651, SERI/TR-11052-2) Avail. NTIS HC A05/MF
A01

Passive cyclic pitch variation using an automatic yaw control system was investigated. The atmospheric test equipment consisted of a horizontal axis wind turbine with vane controlled upwind two bladed rotor of 7.6 m diameter with passive cyclic pitch variation. An automatically triggered electric furl actuator prevented overspeeds and overtorques by furling the rotor which means yawing the rotor out of the winds. The atmospheric test equipment was modified to accept two alternative fully automatic yaw or furl control systems. The first system included a hydraulic single acting constant speed governor as it is used for aircraft propeller controls. The second automatic control system was of a purely mechanical passive type. The analytically predicted and experimentally substantiated negative rotor yaw damping would cause excessive furling rates unless alleviated by a furl damper. The tests were supported by a dynamic yawing analysis. Both analysis and tests indicate that the two bladed passive cyclic

pitch wind rotor can be effectively torque or speed limited by rotor yaw control systems which are less costly and more reliable than the conventional blade feathering control systems DOE

N83-21549# Physical Sciences, Inc., Andover, Mass.
SYSTEMS ANALYSIS OF ON-SITE INTEGRATED ENERGY SYSTEMS, PHASE 1 Final Report
 S BLOOMFIELD, M. HELLER, and G WILEMSKI 20 Sep. 1982
 149 p refs
 (Contract DE-AC01-81FE-15078)
 (DE83-000044, DOE/FE-15078/1) Avail NTIS HC A07/MF A01

The objective was to study the effect of technology variation on the cost and performance of on-site (OSIES) fuel cell power plants and to provide systems analysis codes and models for DOE use in their technology assessment. The approach followed was to develop a systems model of a 40 kW OSIES power plant using the thermodynamic analysis capabilities of the PSI/S3E program. A cost model of the power plant was developed. This code uses a VisiCalc spreadsheet analysis, allowing sensitivity studies to be performed quickly. Several PSI/S3E models to simulate the advanced technologies were updated and these models were incorporated into the existing power plant simulation code. The effect of technology variations on power plant cost and efficiency were determined DOE

N83-21550# Los Alamos Scientific Lab., N. Mex.
FEASIBILITY EVALUATION OF FUEL CELLS FOR SELECTED HEAVY-DUTY TRANSPORTATION SYSTEMS
 J R HUFF and H S MURRAY Oct 1982 46 p refs
 (Contract W-7405-ENG-36)
 (DE83-002953, LA-9488-MS) Avail NTIS HC A03/MF A01

A study of the feasibility of using fuel cell power plants for heavy duty transportation applications is performed. It is concluded that it will be feasible to use fuel cell technology projected as being available by 1995 to 2000 for powering 3000-hp freight locomotives and 6000-hp river boats. The fuel cell power plant is proposed as an alternative to the currently used diesel or diesel-electric system. Phosphoric acid and solid polymer electrolyte fuel cells are determined to be the only applicable technologies in the desired time frame. Methanol, chemically reformed to produce hydrogen, is determined to be the most practical fuel for the applications considered. Feasibility is determined on the basis of weight and volume constraints, compatibility with existing propulsion components, and adequate performance relative to operational requirements. Simulation results show that performance goals are met and that overall energy consumption of heavy duty fuel cell power plants is lower than that of diesels for the same operating conditions. Overall energy consumption is substantially improved over diesel operation for locomotives DOE

N83-21571# Foster-Miller Associates, Inc., Waltham, Mass.
DESIGN AND COMPONENT TESTING OF A LOW-TEMPERATURE WASTE-HEAT-DRIVEN REFRIGERATION SYSTEM, PHASES 1 AND 2 Progress Report
 S HYNEK, H BORHANIAN, I KREPCHIN, D WALKER, C MARIANO, H FULLER, and K LEE Mar. 1982 301 p refs
 (Contract W-7405-ENG-26)
 (DE82-014721, ORNL/SUB-80/28906/1) Avail NTIS HC A14/MF A01

The design and the component testing of a 20 ton refrigeration system powered by 140 F waste heat was completed. A major advantage of such a system is that essentially all operating power comes from the waste heat with only minor injections of auxiliary power. This Rankine-Rankine system uses R-22 for both power and refrigeration cycles. A single semihemetic housing contains the expander, compressor, feed pump, and motor/generator. The integral induction motor/generator acts as a starter, makes up shaft power deficits, absorbs shaft power surpluses, and provides overspeed protection. Experiments determined that 0.0015 in is the optimum axial clearance for the gerotor R-22 evaporator feed pump to minimize both friction and backleakage, that oil injection to the pump had no effect on either friction or backleakage, and

that a centrifugal inducer was needed to prevent cavitation under certain operating conditions. DOE

N83-21577# Central Wayne County Sanitation Authority, Dearborn Heights, Mich.
ENERGY RECOVERY AND COGENERATION FROM AN EXISTING MUNICIPAL INCINERATOR. PHASE 2A: FINAL DESIGN Progress Report
 Feb 1982 70 p
 (Contract DE-FG01-79CS-20232)
 (DE82-007911, DOE/CS-20232/2) Avail NTIS HC A04/MF A01

A feasibility study was prepared on energy recovery and cogeneration from an existing municipal incinerator in Wayne County, Michigan. The mechanical, electrical, structural, and instruments and controls equipment designs were established in sufficient depth to arrive at a construction cost estimate. The designs are described. All of the flue gas generated from each incinerator is directed into a waste heat boiler that will generate steam. A waste heat boiler will be provided for each of the three incinerators. Steam from these waste heat boilers will supply energy to two turbine-generators, which, in turn, will supply auxiliary power to the incinerator plant; the balance of the power will be sold to Detroit Edison Company (DEC). Exhaust steam from each turbine will be directed into a surface condenser operating under vacuum. The water to be supplied to each condenser will be recirculated water that has been cooled by means of a cooling tower DOE

N83-21591# Department of Energy, Houston, Tex.
THE VARIABLE PRESSURE SUPERCRITICAL RANKINE CYCLE FOR INTEGRATED NATURAL GAS AND POWER PRODUCTION FROM THE GEOPRESSURED GEOTHERMAL RESOURCE
 F L GOLDSBERRY Mar. 1982 49 p refs
 (DE82-008957; NVO-240) Avail NTIS HC A03/MF A01

A small-scale power plant cycle that utilizes both a variable pressure vaporizer (heater) and a floating pressure (and temperature) air-cooled condenser is described. Further, it defends this choice on the basis of classical thermodynamics and minimum capital cost by supporting these conclusions with actual comparative examples. The application suggested is for the geopressured geothermal resource. The arguments cited in this application apply to any process (petrochemical, nuclear, etc.) involving waste heat recovery. DOE

N83-21599# United Technologies Research Center, East Hartford, Conn.
DEVELOPMENT OF AN OSCILLATING-VANE CONCEPT AS AN INNOVATIVE WIND-ENERGY-CONVERSION SYSTEM
 R. L. BIELAWA Mar. 1982 114 p refs
 (Contract DE-AC02-77CH-00178; EG-77-C-01-4042)
 (DE82-012870, SERI/TR-98085-2) Avail NTIS HC A06/MF A01

The practicality is investigated of an oscillating vane wind energy conversion system, which incorporated the bending torsion flutter characteristics of a cantilevered wing. The system, characterized by relatively large response amplitudes, employs a construction scheme based on the high fatigue strength characteristics of a composite material. Results are presented of experimental and analytic studies to provide technical data upon which we can assess the concept. Two variants of the concepts are examined: single vane and split vane configurations. The experimental results consist of the mechanical power generation and dynamic response and stress characteristics for a model having a span of approximately one meter. Two complementary analyses are described: (1) a linear flutter eigensolution to calculate conditions for self start and flutter response amplitude ratios, and (2) a nonlinear time history analysis to calculate output power characteristics DOE

05 ENERGY CONVERSION

N83-21601# South Dakota School of Mines and Technology, Rapid City

ENERGY FROM HUMID AIR

T. K. OLIVER, W. N. GROVES, and C. L. GRUBBER Jun 1982 109 p refs

(Contract DE-AC01-79ET-23052, EG-77-C-01-4042)

(DE82-017121; SERI/TR-211-1539) Avail: NTIS (US Sales Only) HC A06/MF A01, DOE Depository Libraries

A cost effective process using a vortex mechanization of an expansion-compression cycle to convert the energy from humid air into mechanical work, which can be used to drive an electrical generation was investigated. A computer model was established and applied to the problem to estimate the system losses and performance potential of the concept. A machine design based on the concept is given. DOE

N83-21602# Aerospace Systems, Inc., Burlington, Mass
ASI/PINSON 1-KILOWATT HIGH-RELIABILITY WIND SYSTEM DEVELOPMENT. PHASE 1: DESIGN AND ANALYSIS

R. B. NOLL, N. D. HAM, H. M. DREES, and L. B. NICHOL Mar 1982 369 p refs

(Contract DE-AC04-76DP-03533)

(DE82-016128; RFP-3046/2) Avail: NTIS HC A16/MF A01

A high reliability version of a vertical axis machine called the Cycloturbine were developed. The final design is a 15 ft diameter turbine with three straight 8 ft blades controlled by a tilt cam mechanism. The tilt cam mechanism controls blade cyclic pitch amplitudes in a manner similar to a helicopter swash plate. The turbine has a power coefficient of 0.4 at an optimum tip speed ratio of 3.0 which results in a rotational speed of 112 RPM in a 9m/sec wind. The electrical system provides 1 kW of 24 V dc power in a 9m/sec wind by means of a flux switching alternator. The electronic circuitry, designed with high reliability components, consists of a voltage regulator and a power rectifier. A dump load circuit is provided as an option. Two transient protection networks are included, one on the tower for the alternator and the other to protect circuitry in the control building. DOE

N83-21608# Sandia Labs., Albuquerque, N. Mex.

FINITE-ELEMENT ANALYSIS AND MODAL TESTING OF A ROTATING WIND TURBINE

T. G. CARNE, D. W. LOBITZ, A. R. NORD, and R. A. WATSON Oct. 1982 16 p refs. Previously announced as A82-30163

(Contract DE-AC04-76DP-00789)

(DE83-002609, SAND-82-0345) Avail: NTIS HC A02/MF A01

A finite element procedure, which includes geometric stiffening, and centrifugal and Coriolis terms resulting from the use of a rotating coordinate system, was developed to compute the mode shapes and frequencies of rotating structures. Special applications of this capability was made to Darrieus, vertical axis wind turbines. In a parallel development effort, a technique for the modal testing of a rotating vertical axis wind turbine is established to measure modal parameters directly. Results from the predictive and experimental techniques for the modal frequencies and mode shapes are compared over a wide range of rotational speeds. DOE

N83-21622# Pacific Northwest Lab., Richland, Wash.

THE WAKE OF THE MOD-OA1 WIND TURBINE AT TWO ROTOR DIAMETERS DOWNWIND ON DECEMBER 3, 1981

J. R. CONNELL and R. L. GEORGE Nov. 1982 61 p refs

(Contract DE-AC06-76RL-01830)

(DE83-003305; PNL-4210) Avail: NTIS HC A04/MF A01

The wake of the MOD-OA1 wind turbine at Clayton, New Mexico was measured using a vertical plane array of anemometers in a crosswind plane at distance of two rotor diameters directly downwind of the turbine. Rotor blade vortices were well mixed into the wake turbulence and were not separately detectable. Wake swirl about the along-wind axis had a value not greater than 0.025 rad/s. Extra turbulence energy existed in the edge of the wake at a frequency of about $n=0.025$ Hz. The cross-wake plane analyses of wind speeds revealed a nearly circular inner portion and a strongly elliptical portion. The elliptical portion major axis was

horizontal. An estimate of the average rate of reenergizing of the wake, using measurements of mean wind energy flow and turbine power, suggests that entrainment with ambient air may be rapid. Some wake characteristics were compared with the corresponding ones for several simple wake models based upon concepts of mixing of ambient air into a wake or an equivalent coaxial jet. DOE

N83-21623# Aluminum Co. of America, Alcoa Center, Pa. DEVELOPMENT AND DEMONSTRATION OF PROCESS AND COMPONENTS FOR THE CONTROL OF ALUMINUM-AIR-BATTERY ELECTROLYTE COMPOSITION THROUGH THE PRECIPITATION OF ALUMINUM TRIHYDROXIDE Final Report

Lawrence Livermore Lab 11 May 1982 382 p refs

(Contract W-7405-ENG-48)

(DE83-002490, UCRL-15503) Avail: NTIS HC A17/MF A01

Physical property data on density, viscosity, and electrical conductivity were developed and reduced to correlation form for synthetic electrolytes containing nominally 7 g/L Sn and 0.20 g/L Ga in 3,4,5,6 M NaOH. Concentrations of $Al(OH)_4$ were selected at six levels for each NaOH concentration and ranged from 0 to as high as 4 M $Al(OH)_4$ at 6 M NaOH. The effect of the Sn and Ga impurities was the increased density by a relatively small percentage, increased viscosity by a significant percentage, and decreased electrical conductance by a significant percentage. Precipitation rate was negatively affected by tin in solution, with a 40% reduction in the rate constant. Both Sn and Ga coprecipitated with the $Al(OH)_3$ to an extent strongly dependent on temperature. Very high precipitation rates resulted in Na levels in product exceeding the target level of 0.24% Na on the hydrate basis. The incorporation of Na in product was also a strong function of temperature. A total of 108 computer simulations were performed and documented to delineate the region of feasible operation with respect to meeting the aluminate production specification. A full scale precipitator was operated in a continuous mode to assess production rate, population changes with time, and hardware aspects. DOE

N83-21633# Pacific Northwest Lab., Richland, Wash.

COMPARISON OF MODEL AND OBSERVATIONS OF THE WAKE OF A MOD-OA WIND TURBINE

J. C. DORAN and K. R. PACKARD Oct. 1982 38 p refs

(Contract DE-AC06-76RL-01830)

(DE83-002882, PNL-4433) Avail: NTIS HC A03/MF A01

A series of wind velocity measurements upwind and downwind of the MOD-OA wind turbine at Clayton, New Mexico, was used to determine some of the characteristics of wakes within approximately two blade diameters of the machine. The magnitudes and shapes of the velocity profiles downwind of the turbine were compared with results obtained from a model. Generally good agreement was obtained at speeds well below the rated speed of the MOD-OA, but the results were not as satisfactory for higher values. DOE

N83-22030# California Univ., Livermore Lawrence Livermore Lab. Transportation Systems Research Div

ROADWAY-POWERED ELECTRIC-VEHICLE IMPACT STUDY ANALYSIS OF SELECTED UTILITY-SERVICE AREAS

V. R. LATORRE and L. R. SPOGEN Sep. 1982 85 p refs

(Contract W-7405-ENG-48)

(DE83-003143, UCID-19591) Avail: NTIS HC A05/MF A01

A Roadway Powered Electric Vehicle (RPEV) derives energy needed for propulsion from two sources. It derives energy from the roadway by magnetic coupling and uses onboard stored energy when off the powered roadway. Possible candidates for supplying needed onboard energy are a secondary battery and an internal combustion engine. When miles normally traveled by internal combustion engine vehicles (ICEV) are replaced by RPEV travel, petroleum consumed (if any) in generating electrical energy for the roadway and for recharge of secondary batteries may be less than that which would be consumed by the ICEV. Thus, a savings in petroleum may result. The price paid for this savings may be

an impact on the operating margins of the utilities supplying the electrical energy. Petroleum savings and utility impact results from RPEV usage in areas serviced by ten US utilities. Careful selection of the utilities analyzed has led to a spectrum of results. DOE

N83-22404# Ames Lab, Iowa Dept of Chemical Engineering
STUDY OF THE ELECTROWINNING OF COPPER USING A FLUIDIZED-BED ELECTROCHEMICAL REACTOR M.S. Thesis
D L FELKER Dec 1982 141 p refs
(Contract W-7405-ENG-82, DI-MS-G1-106002)
(DE83-004854, IS-T-1028) Avail. NTIS HC A07/MF A01

The use of a fluidized bed electrochemical reactor for the recovery of copper from aqueous solutions was studied. Electrolyte solutions containing 0 to 8 g/l copper, 0 to 8 g/l iron and 200 g/l sulfuric acid were used. Porous diaphragms were used to separate the cathode and anode regions. The current efficiency, energy consumption rate and volumetric reaction rate were calculated for the experimental conditions. When the catholyte and anolyte are circulated from a common reservoir and iron (II) is present in the electrolyte, the energy consumption rate exhibits a minimum value of about 1.5 kWh/lb a volumetric reaction rate (VRR) of about 100 lb Cu/m(3) h. When the anolyte and catholyte are separated, the energy consumption rate rises linearly with VRR, being about 1 kWh/lb Cu at 100 lb Cu/m(3) h (this is roughly 2x the VRR of a conventional electrowinning cell). The optimum bed width in the direction of current flow was about 2 cm. A mathematical model which takes into account the dissolution of copper by ferric ion and oxygen is shown to explain the changes in the current efficiency and the VRR with current density seen in most of the experiments. DOE

N83-22484# Massachusetts Inst of Tech., Cambridge
COMPUTER-AIDED INDUSTRIAL PROCESS DESIGN. THE ASPEN PROJECT Final Report, 1 Jun. 1976 - 30 Nov. 1981
1 Feb 1982 39 p refs
(Contract DE-AT01-76ET-10696, E(49-18)-2295)
(DE82-014469; MIT-2295T9-18) Avail. NTIS HC A03/MF A01

The ASPEN Project was carried out at the Massachusetts Institute of Technology from 1976-1981. This report formally documents the work completed under the main contract between MIT and the US Department of Energy (Contract No. E(49-18)-2295 Task No. 9). In addition to the main contract, there were related contracts between MIT and the US Department of Energy on which work was reported separately. The project deliverables consisted of the source code and test problems for the ASPEN system on computer tape and a final report. The User Manual (1348 pages), the System Administrator Manual (1170 pages), and the Technical Reference Manual (1026 pages), and On-Line Documentation (Computer-Generated Tables) on magnetic tape were deliverables on a related, but separate contract. The source code versions of the system itself were provided, with installation instructions, for four different computers and operating system (IBM/OS, IBM/CMS, DEC/VAX, and Univac). DOE

N83-22607# General Electric Co., Schenectady, N. Y. Gas Turbine Div
HIGH-TEMPERATURE TURBINE TECHNOLOGY PROGRAM. VOLUME 5: MATERIALS TECHNOLOGY DEVELOPMENT Final Report
30 Nov 1982 515 p refs
(Contract DE-AC01-76ET-10340, EX-76-C-01-1806)
(DE83-004330, DOE/ET-10340/127-VOL-5) Avail. NTIS HC A22/MF A01

A high temperature gas turbine, for use in a combined cycle power plant operating on a coal derived fuel was developed. Comprehensive descriptions of the resulting high temperature turbine component and system designs, test facilities and test results relative to component, subsystem, and system design performance and degree of technology readiness are included. DOE

N83-22739*# Foster-Miller Associates, Inc., Waltham, Mass
DESIGN OF HYDRAULIC OUTPUT STIRLING ENGINE Final Report
W. M. TOSCANO, A. C. HARVEY, and K. LEE Jan. 1983 130 p refs
(Contract NAS3-22230)
(NASA-CR-167976, NAS 1.26:167976) Avail. NTIS HC A07/MF A01 CSDL 10B

A hydraulic output system for the RE-1000 free piston Stirling engine (FPSE) was designed. The hydraulic output system can be readily integrated with the existing hot section of RE-1000 FPSE. The system has two simply supported diaphragms which separate the engine gas from the hydraulic fluid, a dynamic balance mechanism, and a novel, null center band hydraulic pump. The diaphragms are designed to endure more than 10 billion cycles, and to withstand the differential pressure load as high as 14 MPa. The projected thermodynamic performance of the hydraulic output version of RE-1000 FPSE is 1.87 kW at 29/7 percent brake efficiency. S.L.

N83-22740*# Massachusetts Inst of Tech., Cambridge. Aeroelastic and Structures Research Lab
SOME EXPERIMENTS ON YAW STABILITY OF WIND TURBINES WITH VARIOUS CONING ANGLES Final Report
D BUNDAS and J DUGUNDJI Jul. 1981 31 p refs
(Contract NSG-3303; DE-AI01-76ET-20320)
(NASA-CR-168108, DOE/NASA/3303-1; NAS 1.26:168108; MIT-ASRL-TR-197-2) Avail. NTIS HC A03/MF A01 CSDL 10B

A horizontal axis wind turbine was constructed to study the effect of coning angle on the yawing moments produced. Coning angles of 0 deg, +10 deg and -10 deg were studied in the upwind and downwind cases. Moment and rotational frequency of the blades at each yaw angle setting were taken. It was found that as the coning angle increased from -10 deg to +10 deg in either the upwind or downwind case the stability decreased. The downwind case was slightly more stable for all coning angles than was the upwind case. It is found that all the previous cases were stable for high rotation speeds, but at lower rotation speeds, they were all unstable and could not self start unless held in the wind. E.A.K.

N83-22746*# IIT Research Inst., Chicago, Ill
FATIGUE TESTING OF LOW-COST FIBERGLASS COMPOSITE WIND TURBINE BLADE MATERIALS Final Report
K E HOFER and L. C. BENNETT Nov 1981 89 p refs
(Contract DEN3-182; DE-AI01-79ET-20320)
(NASA-CR-165566; DOE/NASA/0182-1; NAS 1.26:165566; IITRI-M06066-22) Avail. NTIS HC A05/MF A01 CSDL 10B

The static and fatigue behavior of transverse filament tape (TFT) fiberglass/epoxy and TFT/polyester composites was established by the testing of specimens cut from panels fabricated by a filament winding process used for the construction of large experimental wind turbine blades. Author

N83-22747*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
DEVELOPMENT OF METHODOLOGY FOR HORIZONTAL AXIS WIND TURBINE DYNAMIC ANALYSIS Final Summary Report
J DUGUNDJI Sep 1982 11 p refs
(Contract NSG-3303; DE-AI01-76ET-20320)

(NASA-CR-168110; DOE/NASA/3303-4; NAS 1.26:168110; MIT-ASRL-TR-197-5) Avail. NTIS HC A02/MF A01 CSDL 10B
Horizontal axis wind turbine dynamics were studied. The following findings are summarized: (1) review of the MOSTAS computer programs for dynamic analysis of horizontal axis wind turbines; (2) review of various analysis methods for rotating systems with periodic coefficients; (3) review of structural dynamics analysis tools for large wind turbine; (4) experiments for yaw characteristics of a rotating rotor; (5) development of a finite element model for rotors; (6) development of simple models for aeroelastics; and (7) development of simple models for stability and response of wind turbines on flexible towers. E.A.K.

05 ENERGY CONVERSION

N83-22748*# Gilbert (Glen A) and Associates, Inc., Reading, Pa

PARAMETRIC ANALYSIS OF CLOSED CYCLE MAGNETOHYDRODYNAMIC (MHD) POWER PLANTS Final Report

W OWENS, R BERG, R MURTHY, and J. PATTEN Sep 1981 284 p refs

(Contract DEN3-136, DE-AI01-77ET-10769)

(NASA-CR-165472, DOE/NASA/0136-1, NAS 1.26:165472)

Avail NTIS HC A13/MF A01 CSCL 10B

A parametric analysis of closed cycle MHD power plants was performed which studied the technical feasibility, associated capital cost, and cost of electricity for the direct combustion of coal or coal derived fuel. Three reference plants, differing primarily in the method of coal conversion utilized, were defined. Reference Plant 1 used direct coal fired combustion while Reference Plants 2 and 3 employed on site integrated gasifiers. Reference Plant 2 used a pressurized gasifier while Reference Plant 3 used a "state of the art" atmospheric gasifier. Thirty plant configurations were considered by using parametric variations from the Reference Plants. Parametric variations include the type of coal (Montana Rosebud or Illinois No. 6), clean up systems (hot or cold gas clean up), on or two stage atmospheric or pressurized direct fired coal combustors, and six different gasifier systems. Plant sizes ranged from 100 to 1000 MWe. Overall plant performance was calculated using two methodologies. In one task, the channel performance was assumed and the MHD topping cycle efficiencies were based on the assumed values. A second task involved rigorous calculations of channel performance (enthalpy extraction, isentropic efficiency and generator output) that verified the original (task one) assumptions. Closed cycle MHD capital costs were estimated for the task one plants; task two cost estimates were made for the channel and magnet only. S L

N83-22749*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio

TESTS OF AN ALTERNATING CURRENT PROPULSION SUBSYSTEM FOR ELECTRIC VEHICLES ON A ROAD LOAD SIMULATOR Final Report

F. J. STENGER Dec 1982 42 p refs

(Contract DE-AI01-77CS-51044)

(NASA-TM-83036, E-1479; DOE/NASA/51044-29, NAS

1 15:83036) Avail. NTIS HC A03/MF A01 CSCL 13F

The test results of a breadboard version of an ac electric-vehicle propulsion subsystem are presented. The breadboard was installed in the NASA Lewis Research Center Road Load Simulator facility and tested under steady-state and transient conditions. Steady-state tests were run to characterize the system and component efficiencies over the complete speed-torque range within the capability of the propulsion subsystem in the motoring mode of operation. Transient tests were performed to determine the energy consumption of the breadboard over the acceleration and cruise portions of SAE J227 and driving schedules B, C, and D. Tests in the regenerative mode were limited to the low-gear-speed range of the two speed transaxle used in the subsystem. The maximum steady-state subsystem efficiency observed for the breadboard was 81.5 percent in the high-gear-speed range in the motoring mode, and 76 percent in the regenerative braking mode (low gear). The subsystem energy efficiency during the transient tests ranged from 49.2 percent for schedule B to 68.4 percent for Schedule D. M G.

N83-22771# California Univ., Livermore Lawrence Livermore Lab. Transportation Systems Research.

FUEL-CELL TECHNOLOGY ASSESSMENT. VOLUME 2: EVALUATION OF JAPAN

V. R. LATORRE and L. R. SPOGEN, JR. 15 Aug 1982 32 p 5 Vol

(Contract W-7405-ENG-48)

(DE83-004146, UCID-19412-VOL-2) Avail NTIS HC A03/MF

A01

The potential for US fuel cell technology in selected countries was evaluated. The results of the evaluations and the pertinent

factors which influenced their outcome are given. Data for Japan is given. DOE

N83-22772# California Univ., Livermore Lawrence Livermore Lab. Transportation Systems Research.

FUEL-CELL TECHNOLOGY ASSESSMENT. VOLUME 3: EVALUATION OF TUNISIA

V. R. LATORRE and L. R. SPOGEN, JR. 15 Aug 1982 27 p 5 Vol

(Contract W-7405-ENG-48)

(DE83-004294, UCID-19412-VOL-3) Avail NTIS HC A03/MF

A01

The potential for US fuel cell technology in selected countries was evaluated. The results of the evaluations and the pertinent factors which influenced their outcome are given. Data for Tunisia is given. DOE

N83-22773# California Univ., Livermore Lawrence Livermore Lab. Transportation Systems Research.

FUEL-CELL TECHNOLOGY ASSESSMENT. VOLUME 5: EVALUATION OF SOUTH KOREA

V. R. LATORRE and L. R. SPOGEN, JR. 15 Aug 1982 24 p 5 Vol

(Contract W-7405-ENG-48)

(DE83-004299, UCID-19412-VOL-5) Avail NTIS HC A02/MF

A01

The potential for US fuel cell technology in selected countries was evaluated. The results of the evaluations and the pertinent factors which influenced their outcome are given. The report is in five volumes. Data for South Korea is given. DOE

N83-22780# Stapenhorst (F. W. E.), Inc., Pointe Claire (Quebec)

DOE SMALL-SCALE HYDROELECTRIC DEMONSTRATION PROGRAM. F. W. E. STAPENHORST, INC., GOODYEAR LAKE HYDROELECTRIC-GENERATING-STATION REDEVELOPMENT Annual Report, 11 Aug. 1981 - 10 Aug. 1982

1982 215 p refs

(Contract DE-FC07-79RA-23211)

(DE83-003156, DOE/RA-23211/3; AR-2) Avail NTIS HC

A10/MF A01

Monthly and year long data on the performance, maintenance, power generation, flow conditions, and operating costs during the period from August 11, 1981 to August 10, 1982 at the Goodyear Lake (New York) small-scale hydroelectric power plant are presented. During this period the plant generated 5,806,500 kWh of power for a total income of \$194,401, which represents approximately 79% of predicted values. The shortfall in output resulted from the failure of Generator Unit No. 1 which was out of operation for two months. DOE

N83-22783# CACI, Inc. - Federal, San Diego, Calif

PRODUCTION COSTING OF AN ADVANCED/INNOVATIVE WIND ENERGY CONCEPT (AIWEC): EXTENSION OF THE SAMICS METHODOLOGY

B. KLEINE and J. C. CALLAHAN Nov 1982 138 p

(Contract DE-AC02-77CH-00178; EG-77-C-01-4042)

(DE83-003085; SERI/TR-98282-2) Avail NTIS HC A07/MF

A01

The Standard Assembly-line Manufacturing Industry Costing Standards (SAMICS) were designed as a tool for estimating the price of a manufactured product based on an assembly-line production facility. The cost of products such as the McDonnell Douglas 40-kW Giromill, which cannot be manufactured on an assembly line in small quantities, could not be analyzed using the standard SAMICS methodology. To analyze the cost of such products using SAMICS, it was necessary to adapt the standard methodology for application to a job shop configuration. The resulting methodology extension is reported. DOE

N83-22784# Energy Research and Development International, Inc., Pittsburgh, Pa.

DYNAMIC INTERACTION BETWEEN AN OTEC POWER PLANT AND A POWER GRID Final Report

31 Aug 1982 141 p refs

(Contract DE-AC02-80RA-50274)

(DE83-002862, DOE/RA-50274/1) Avail NTIS HC A07/MF A01

The objectives of the research reported are to identify and resolve potential technical problems that may arise from the incorporation of an OTEC power plant in the existing generation mix of Puerto Rico and to develop the tools and to identify the technical resources needed for dynamic analysis of island power systems to which OTEC power plants provide a substantial portion of the load demand. The issues addressed are system modeling and data gathering, network simplification, selection of OTEC plant site and power system, stability analysis, and economic dispatch when OTEC power plants contribute substantially to the island's load. The slow dynamics of the OTEC plant make it a reference for the rest of the power system during a transient, but this slowness is a drawback in terms of system recovery from fault-induced transients. It is found that simple dynamic models can, in most instances, describe the transient behavior of both the OTEC plant and the island's power system, but it was not possible to reduce the non-OTEC portion of the power system to a single generation point and a single load. DOE

N83-22787# Westinghouse Research and Development Center, Pittsburgh, Pa.

EVALUATION OF GASIFICATION AND GAS CLEANUP PROCESSES FOR USE IN MOLTEN CARBONATE FUEL CELL POWER PLANTS Final Report

G. JABLONSKI, J. R. HAMM, M. A. ALVIN, R. A. WENGLARZ, and P. PATEL 1982 497 p refs

(Contract DE-AC21-81MC-16220)

(DE83-003821; DOE/MC-16220/1306) Avail NTIS HC A21/MF A01

Coal gasifiers and gas cleanup systems suitable for supplying fuel to molten carbonate fuel cells (MCFC) in industrial and utility power plants are listed. Those coal gas cleanup systems rejected by DOE's MCFC contractors for their power plant systems by virtue of the resources required for those systems to be commercially developed are characterized. An analytical model to predict MCFC tolerance for particulates on the anode (fuel gas) side of the MCFC was developed. An analytical model to predict MCFC anode side tolerance for chemical species, including sulfides, halogens, and trace heavy metals was developed. The candidate gasifier/cleanup systems those most suitable for MCFC-based power plants are discussed. A reference wet cleanup system, parametric analyses of the coal gasifiers and gas cleanup systems, efficiency, investment, cost of electricity, operability, and environmental effect rankings, and a final report are discussed. DOE

N83-22810# California Univ., Livermore. Lawrence Livermore Lab. Transportation Systems Research Dept.

FUEL-CELL TECHNOLOGY ASSESSMENT. VOLUME 4. EVALUATION OF TAIWAN

V. R. LATORRE and L. R. SPOGEN, JR 15 Aug 1982 27 p 5 Vol

(Contract W-7405-ENG-48)

(DE83-004160, UCID-19412-VOL-4) Avail NTIS HC A03/MF A01

The potential for US fuel-cell technology in selected countries was evaluated. The results of the evaluations and the pertinent factors which influence their outcome are given. Data for Taiwan is given. DOE

N83-22817# Oak Ridge National Lab., Tenn. Energy Div.

HEAT-ACTIVATED HEAT-PUMP DEVELOPMENT AND POTENTIAL APPLICATION OF STIRLING-ENGINE TECHNOLOGY

P. D. FAIRCHILD and C. D. WEST 1982 43 p refs Presented at the 20th Automotive Technol. Develop. Contractor Coordination Meeting, Dearborn, Mich., 25-28 Oct. 1982

(Contract W-7405-ENG-26)

(DE83-002134; CONF-821055-1) Avail NTIS HC A03/MF A01

Presented is a brief overview of the heat-activated heat pump technology development program being carried out with emphasis on the Stirling engine technology projects. The major projects are reviewed as they were formulated and carried out under the previous product development guidelines. The revised technology development focus and current status of those major hardware projects are discussed. The key issues involved in applying Stirling engine technology to heat pump equipment are assessed. The approach and planned future activities to address those issues are described. Also included are brief descriptions of two projects in this area supported by the Gas Research Institute. DOE

N83-22820# California Univ., Livermore. Lawrence Livermore Lab. Transportation Systems Research Dept.

FUEL-CELL TECHNOLOGY ASSESSMENT. VOLUME 1: THE POTENTIAL VALUE OF US FUEL-CELL TECHNOLOGY IN FOREIGN COUNTRIES

V. R. LATORRE and L. R. SPOGEN, JR 15 Aug. 1982 60 p 5 Vol

(Contract W-7405-ENG-48)

(DE83-004372, UCID-19412-VOL-1) Avail NTIS HC A04/MF A01

Fuel cell power plants are in an advanced state of development. Many factors influence whether these plants will be used in a specific country and whether US industry will supply them. The potential for US fuel cell technology in selected countries (Japan, Tunisia, Taiwan, and South Korea) was evaluated. The results of the evaluations and the pertinent factors which influenced their outcome are provided. The approach, basic data on fuel cells and their competitors for several applications, evaluation procedures, specific country data needed for the evaluation, and the step by step method used are provided. DOE

N83-22827# Arctic Enterprises, Inc., Annapolis, Md.

FUEL-CELL-PROPELLED SUBMARINE-TANKER-SYSTEM STUDY

K. E. COURT, W. H. KUMM, and J. E. OCALLAGHAN Jun. 1982 244 p refs

(Contract DE-AC01-81FE-15086)

(DE82-015149, DOE/FE-15086/1) Avail NTIS HC A11/MF A01

A systems analysis of a commercial Arctic Ocean submarine tanker system to carry fossil energy to markets is presented. The submarine is to be propelled by a modular phosphoric acid fuel cell system. An electric utility type fuel cell will be fueled with methanol. Oxidant will be provided from a liquid oxygen tank carried onboard. The route will be under the polar icecap from a loading terminal located off Prudhoe Bay, Alaska to a transshipment facility postulated to be in a Norwegian fjord. The system throughput of the gas fed methanol cargo will be 450,000 barrels per day. DOE

N83-22832# New Hampshire Univ., Durham. Dept. of Civil Engineering.

SHEBMS: SMALL HYDROELECTRIC BASIN MODELING SYSTEM

Mar 1982 130 p refs

(Contract DE-AC01-80RA-50282)

(DE82-015411, DOE/RA-50282/T1) Avail NTIS HC A07/MF A01

A user manual is presented for the small hydroelectric basis modeling system (SHEBMS) which simulates the performance of a hydroelectric system by collectively simulating the performance of its interconnecting components. These components consist of

05 ENERGY CONVERSION

watersheds, ponds, rivers, dams, penstocks, gates, turbines and generators
DOE

N83-22839# Science Applications, Inc., La Jolla, Calif.
COORDINATION OF THE ONSITE FUEL CELL PROGRAM
Annual Report, Jan. 1981 - May 1982
W. C. RACINE and V. D. FERRARO Sep. 1982 88 p
(PB83-119545, SAI-444-82-170-LJ, GRI-81/00095) Avail. NTIS
HC A05/MF A01 CSCL 10B

The work performed on coordination of the onsite fuel cell program was reported. The overall work was divided into seven areas or tasks: site selection activities, data management activities, hardware, data management activities, software, program scheduling activities, utility coordination and support, business assessment activities and management and reporting. The primary objectives of the 40 kW Onsite Fuel Cell Field Test project are reached.
GRA

N83-23146# Los Alamos Scientific Lab., N. Mex
REENTRY THERMAL TESTING OF A GENERAL PURPOSE HEAT SOURCE FUELED CLAD
D. E. PETERSON and C. E. FRANTZ Mar. 1982 13 p refs
(Contract W-7405-ENG-36)
(DE82-014125; LA-9227) Avail: NTIS HC A02/MF A01

A General Purpose Heat Source module was exposed to heat treatments simulating an isothermal prelaunch condition, followed by thermal pulses corresponding to atmospheric reentry. Helium release rates were determined during each heating and modeled after simple diffusion theory. Following the tests, the module was examined metallurgically with no evidence of swelling of the cladding nor degradation of the fuel.
DOE

N83-23243# California Univ., Livermore. Lawrence Livermore Lab. Transportation Systems Research.
ROADWAY-POWERED ELECTRIC-VEHICLE PROJECT Final Report
C. E. WALTER and J. D. SALISBURY 30 Sep 1982 54 p refs
(Contract W-7405-ENG-48)
(DE83-003147; UCID-19576) Avail: NTIS HC A04/MF A01

The roadway powered electric vehicle (RPEV) project was started in 1979 to conduct tests of the roadway and the vehicle and to investigate the impact on electric utility generating capacity of wide scale deployment of powered roadways. Information is presented on the RPEV system analysis to identify the parameters of importance and to provide a framework for testing; the test facility which contains a 220-m long test track with a 50-m long powered section, the safety, driveability, compatibility, and power loss measurements; cost analysis and benefits of RPEV's and their impact on electric utilities for increased power demand. It is indicated that RPEV's are technically feasible, power pickup efficiencies as high as 96% were obtained, the system is safe, the transportation dependence on petroleum would be reduced by the use of RPEV's, the capital cost of the system is manageable, and the impact on electric utilities depends on the areas in which RPEV's are developed.
DOE

06

ENERGY TRANSPORT, TRANSMISSION, AND DISTRIBUTION

Includes transport of fuels by pipelines, tubes, etc., microwave power transmission, and superconducting power transmission

A83-23464
ON THE CHOICE OF THE OPTIMAL DENSITY OF VIBRATORS FOR A RECTENNA [K VOPROSU O VYBORE OPTIMAL'NOI PLOTNOSTI VIBRATOROV REKTENNY]

G. P. BOIAKHCHIAN, V. A. VANKE, and S. K. LESOTA
Radiotekhnika i Elektronika, vol 28, Feb. 1983, p. 362-365. In Russian. refs

Theoretical calculations relating to the optimization of vibrator density in a rectenna system are presented with particular reference to the development of the microwave transmission system in a satellite solar power system. It is shown that, when the microwave power density in the incident beam is 230 W/sq m or less, the vibrator density can be reduced to 80 per sq m when the width of the rectenna directivity pattern is 10 deg. The effect of load mismatch on the rectenna efficiency is insignificant, amounting to less than 1% for a pattern width of 10 deg.
B.J.

A83-23924
THE RESULTS OF AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF VIBRATION LOADING PARAMETERS ON THE WORKING CHARACTERISTICS OF HEAT PIPES [REZULTATY EKSPERIMENTAL'NOGO ISSLEDOVANIYA VLIYANIYA PARAMETROV VIBRATSIONNYKH NAGRUZOK NA RABOCHIE KHAARAKTERISTIKI TEPLOVOI TRUBY]

M. G. SEMENA and I. U. E. NIKOLAENKO (Kievskii Politekhicheskii Institut, Kiev, Ukrainian SSR) Energetika, Jan. 1983, p. 106-109. In Russian. refs

Experimental results are presented on the effects of vibrational loads on the performance characteristics of heat pipes in evaporating and boiling conditions. The heat pipe is T-shaped, with a vertical part (heating zone) 12 x 25 x 125 mm in size filled with sections of copper tubing having rectangular cross-sections, and a horizontal part (condensation and transport zone) 12 x 52 x 125 mm in size. It is found that vibrational loads having frequencies of 5-4000 Hz and vibrational accelerations of 0.2-15 g exert a significant effect on the thermal resistance and the maximal transmitted heat flux of this heat pipe.
N.B.

A83-24358*# National Aeronautics and Space Administration
Lyndon B. Johnson Space Center, Houston, Tex
THERMAL CONTROL - HEAT BUSES WILL OPERATE LIKE A PUBLIC UTILITY

W. E. ELLIS and J. G. RANKIN (NASA, Johnson Space Center, Houston, TX) Astronautics and Aeronautics, vol 21, Mar 1983, p. 56-61

Active thermal control for the NASA space station concept requires long life heat rejection, highly versatile thermal transport, and efficient system integration. By a significant margin, the heat radiator will be the largest and most exposed portion of the space station thermal system. Transport requirements encompass the collection and movement of thermal energy from the space station's heat sources to the radiator heat sink at required temperature levels. In a decentralized thermal system, each space station module would collect and reject all of the waste heat generated, thereby requiring no module interconnections. This scheme does not, however, allow waste heat from one module to be used by another. In a centralized system, heat must be transported across module boundaries. A high capacity monogroove heat pipe has been developed to simplify space radiators design and operation.
O.C.

A83-25760

A HEAT PIPE SIMULATION TECHNIQUE FOR SPACECRAFT THERMAL TESTING UNDER VARIABLE ORIENTATION

D. BOGGIATTO, P. MESSIDORO, and F. AL-ASTRABADI (Aeritalia S.p.A., Settore Spazio, Turin, Italy) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 12th, San Diego, CA, July 19-21, 1982, SAE 7 p. Research sponsored by the European Space Agency (SAE PAPER 820860)

A technique is presented to test heat pipe equipped spacecraft under any operational sun angle and orientation without adversely affecting the S/C power and temperature distribution that can occur when heat pipes are tilted in a 1-g test environment. The proposed technique is based on a specially designed heater system to simulate the heat pipe performance (i.e., distribution of thermal flux and temperature). The heater system employs temperature predictions generated by computer simulation and a mathematical correlation of the performance of real and simulated heat pipes when operated similarly in a horizontal position. (Author)

A83-27127* Los Alamos Scientific Lab., N. Mex

LONG TITANIUM HEAT PIPES FOR HIGH-TEMPERATURE SPACE RADIATORS

S. P. GIRRENS (Los Alamos National Laboratory, Los Alamos, NM) and D. M. ERNST (Thermacore, Inc., Lancaster, PA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 1 New York, Institute of Electrical and Electronics Engineers, 1982, p. 47-51 (Contract JPL-955935, NAS7-100)

Titanium heat pipes are being developed to provide light weight, reliable heat rejection devices as an alternate radiator design for the Space Reactor Power System (SP-100). The radiator design includes 360 heat pipes, each of which is 5.2 m long and dissipates 3 kW of power at 775 K. The radiator heat pipes use potassium as the working fluid, have two screen arteries for fluid return, a roughened surface distributive wicking system, and a D-shaped cross-section container configuration. A prototype titanium heat pipe, 5.5-m long, has been fabricated and tested in space-simulating conditions. Results from startup and isothermal operation tests are presented. These results are also compared to theoretical performance predictions that were used to design the heat pipe initially. (Author)

A83-27128

ARTERY HEAT PIPES FOR SPACE POWER SYSTEMS

M. MERRIGAN, C. PRENGER, E. MARTINEZ, and J. RUNYAN (Los Alamos National Laboratory, Los Alamos, NM) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 1. New York, Institute of Electrical and Electronics Engineers, p. 52-57 refs

Design requirements and progress on sodium-filled heat pipes for carrying heat from a space-based reactor core to thermoelectric elements are discussed. An operating temperature of 1500 K, coupled to a high evaporator radial power density, has indicated boiling at the evaporator wall. Each heat pipe is required to have a thermal capacity of 15 kWt, an axial power density of 10 kWt, a length of 2 m, and a 90 deg bend around a 180 mm radius reactor. Material choices have been limited to Mo alloys by ductility criteria, although the finest Mo mesh screen material for distribution wicks has a pore size that is a factor of four too large. An artery heat pipe configuration has been selected for redundancy features. Optimization of the wick configuration and permeability are still necessary in the artery configuration. Use of a MoRe alloy for the mesh and liquid lithium for the heat transfer fluid as alternatives for the SP-100 space power system are being considered for the next generation design. D H K

A83-27129

DEVELOPMENT OF HIGH-TEMPERATURE LIQUID METAL HEAT PIPES FOR ISOTHERMAL IRRADIATION ASSEMBLIES

E. S. KEDDY and H. E. MARTINEZ (Los Alamos National Laboratory, Los Alamos, NM) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 1 New York, Institute of Electrical and Electronics Engineers, p. 58-62. refs

Design features, materials considerations, and preliminary test results of the fuel configuration for a 10-100 kWe space-power reactor are reported. The Mo heat pipes, one using liquid Na and another liquid Li, were examined with Mo mesh placed in the interior for fluid distribution and to prevent a gravity return of the condensate. RF heating was used and measurements were made with calorimetry and optical pyrometry. The mesh performed satisfactorily for both heat transfer fluids. The innovative pin geometry, which features layers of UO₂ sandwiched between Mo wafers to provide the major conduction paths to the core heat pipes, will require testing in the EBR-III reactor. The 3.6 MW/sq cm input experienced in the preliminary tests was twice that expected in the EBR III trials, when fuel swelling will also be examined. D H K

A83-27152*# National Aeronautics and Space Administration Lyndon B. Johnson Space Center, Houston, Tex

OPTIMIZATION TECHNIQUE FOR IMPROVED MICROWAVE TRANSMISSION FROM MULTI-SOLAR POWER SATELLITES

G. D. ARNDT and E. M. KERWIN (NASA, Johnson Space Center, Houston, TX) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p. 193-198. refs

An optimization technique for generating antenna illumination tapers allows improved microwave transmission efficiencies from proposed solar power satellite (SPS) systems and minimizes sidelobe levels to meet preset environmental standards. The cumulative microwave power density levels from 50 optimized SPS systems are calculated at the centroids of each of the 3073 counties in the continental United States. These cumulative levels are compared with Environmental Protection Agency (EPA) measured levels of electromagnetic radiation in seven eastern cities. Effects of rectenna relocations upon the power levels/population exposure rates are also studied. (Author)

A83-29457

ORBITAL RING SYSTEMS AND JACOB'S LADDERS. III

P. BIRCH (Marconi Space and Defence Systems, Ltd., Stanmore, Middx., England) British Interplanetary Society, Journal (Interstellar Studies) (ISSN 0007-084X), vol. 36, May 1983, p. 231-238. refs

A method for transferring payloads into space without using rockets is considered. The method makes use of a massive ring in low earth orbit. A comparatively short cable from the ring to the ground (called a Jacob's Ladder) is suspended from a 'Sky Hook'. The skyhooks and ladders are geostationary, but the orbital ring is moving at slightly more than orbital velocity. The complete 'Orbital Ring System' (ORS) appears to be within reach of present-day technology. Part I of this study was devoted to the theoretical aspects of the ORS, while Part II was concerned with aspects of engineering and safety. The present investigation is the third part of the study. It is concerned with problems of providing power from space, taking into account solar power obtained from high or geosynchronous orbit, power from gravitational energy, an earth orbit light-sail windmill, and a solar orbit light-sail windmill. Further uses of orbital ring systems are related to space platforms, super-Jovian planets, and super-stellar planets. G.R.

06 ENERGY TRANSPORT, TRANSMISSION, AND DISTRIBUTION

N83-16630*# General Electric Co., Philadelphia, Pa Space Div

DESIGN STUDY OF A HIGH POWER ROTARY TRANSFORMER

S. M. WEINBERGER Jul 1982 59 p refs
(Contract NAS3-23155)
(NASA-CR-168012; NAS 1.26-168012, GE-82SDS4222) Avail:
NTIS HC A04/MF A01 CSCL 09C

A design study was made on a rotary transformer for transferring electrical power across a rotating spacecraft interface. The analysis was performed for a 100 KW, 20 KHz unit having a "pancake" geometry. The rotary transformer had a radial (vertical) gap and consisted of 4-25 KW modules. It was assumed that the power conditioning comprised of a Schwarz resonant circuit with a 20 KHz switching frequency. The rotary transformer, mechanical and structural design, heat rejection system and drive mechanism which provide a complete power transfer device were examined. The rotary transformer losses, efficiency, weight and size were compared with an axial (axial symmetric) gap transformer having the same performance requirements and input characteristics which was designed as part of a previous program. The "pancake" geometry results in a heavier rotary transformer primarily because of inefficient use of the core material. It is shown that the radial gap rotary transformer is a feasible approach for the transfer of electrical power across a rotating interface and can be implemented using presently available technology. Author

N83-17342# Brookhaven National Lab., Upton, N. Y. Metallurgy and Materials Science Div.

METALLURGICAL ASPECTS OF INTERSTRAND RESISTANCE

M. SUENAGA 1981 13 p refs Presented at the US-Japan Superconductive Magnetic Energy Storage Workshop, Madison, Wis., 19 Oct. 1981

(Contract DE-AC02-76CH-00016)
(DE82-005504, BNL-30435; CONF-811051-3) Avail. NTIS HC A02/MF A01

Contact resistance between wires in superconducting cables is one of the primary factors determining losses in the conductor under time-varying magnetic fields, and values of the resistance are often used for the calculation of the losses in the conductor under time-varying magnetic fields, and values of the resistance are often used for the calculation of the losses in magnets without actual measurements of the values. Some measurements of the contact resistance, which were made for various purposes at Brookhaven National Laboratory, are presented emphasizing metallurgical aspects influencing contact resistance between two metals. DOE

N83-18033# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).

STUDY BASED ON AMMONIA/WATER SOLUTIONS OF A DISTRICT HEATING TRANSPORT SYSTEM Final Report, Jun. 1981

J. P. HOFFMANN Bonn Bundesministerium fuer Forschung und Technologie Oct. 1982 193 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-82-188; ISSN-0340-7608) Avail: NTIS HC A09/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 36

The technical and economical capabilities of ammonia-water solutions for the transport of heat from a large cogenerating power plant to a transfer station near the consumers were studied. The necessary mass flows are established at ambient temperatures within cold pipelines. Based on the thermodynamics of ammonia-water solutions a class of cycles suitable for heat transport was defined by using a computer program for the technical and economical aspects. Specific costs of heat transport were compared with the cost of a conventional hot water system. It is shown that an ammonia-water system has economical advantages, if the heat load is smaller than about 300 MJ/s and the transport distance exceeds 60 km. E.A.K.

N83-18102# Dames and Moore, Washington, D. C.

ENVIRONMENTAL IMPACTS OF UNDERGROUNDING HIGH-VOLTAGE TRANSMISSION: HEALTH AND SAFETY

M. D. MALONEY 1981 12 p refs Presented at the 3rd Symp. on Environ. Concerns in Rights-of-Way Management, San Diego, Calif., 15 Feb. 1982

(Contract DE-AC01-78ET-29163)
(DE82-010108; DOE/ET-29163/1, CONF-820215-2) Avail. NTIS HC A02/MF A01

Electric and electromagnetic effects of transmission cables are described quantitatively, together with an indication of the potential impacts to the public health and safety. The three major types of cable systems commercially available, as well as advanced system designs for future applications, are considered at voltage levels from 345 kV to 1100 kV. Both ac and dc cable systems can be designed for minimal impact wherever strict engineering or environmental constraints are appropriate. DOE

N83-19596* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

HEAT PIPES CONTAINING ALKALI METAL WORKING FLUID Patent

J. F. MORRIS, inventor (to NASA) 16 Mar. 1981 4 p Filed 16 Mar. 1981 Supersedes N81-22310 (19 - 13, p 1756)

(NASA-CASE-LEW-12253-1; US-PATENT-4,372,377;
US-PATENT-APPL-SN-243682; US-PATENT-CLASS-165-104.26,
US-PATENT-CLASS-165-134R, US-PATENT-CLASS-29-157.3H)
Avail: US Patent and Trademark Office CSCL 20F

A technique for improving high temperature evaporation-condensation heat-transfer devices which have important and unique advantage in terrestrial and space energy processing is described. The device is in the form of a heat pipe comprising a sealed container or envelope which contains a capillary wick. The temperature of one end of the heat pipe is raised by the input of heat from an external heat source which is extremely hot and corrosive. A working fluid of a corrosive alkali metal, such as lithium, sodium, or potassium transfers this heat to a heat receiver remote from the heat source. The container and wick are fabricated from a superalloy containing a small percentage of a corrosion inhibiting or gettering element. Lanthanum, scandium, yttrium, thorium, and hafnium are utilized as the alloying metal.

Official Gazette of the U.S. Patent and Trademark Office

N83-20060# Oak Ridge National Lab., Tenn. Energy Div **CONCEPTUAL DESIGN AND PERFORMANCE ANALYSIS OF ABSORPTION HEAT PUMPS FOR WASTE-HEAT UTILIZATION**

G. GROSSMAN and H. PEREZ-BLANCO 1982 15 p refs Presented at the Semiannual Meeting of the Am. Soc. of Heating, Refrigerating, and Air Conditioning Engrs., Houston, Tex., 24 Jan. 1982

(Contract W-7405-ENG-26)
(DE82-010202; CONF-820112-4) Avail: NTIS HC A02/MF A01

The purpose of the study is to explore the potential of the absorption cycle for recovering low-temperature waste heat (60 C) as a first step toward the construction of a working system to provide process heat. The system is considered with lithium chloride (LiCl) and lithium bromide (LiBr) water solutions as working fluids. The benefits of multistaging for achieving large temperature boosts are shown. The performance criteria are defined by means of parameters that are relevant to the operation of a waste-heat-actuated cycle. Components and overall system performance of a two-stage heat pump are calculated and the results are discussed. DOE

06 ENERGY TRANSPORT, TRANSMISSION, AND DISTRIBUTION

N83-20155*# National Aeronautics and Space Administration. Pasadena Office, Calif.

HIGH PRODUCTION SHUTTLE CAR SYSTEM FOR COAL MINES Patent Application

E COLLINS, JR, inventor (to NASA) (JPL, California Inst. of Tech., Pasadena) 14 Jan. 1983 13 p

(Contract NAS7-100)

(NASA-CASE-NPO-15949-1; US-PATENT-APPL-SN-457990)

Avail NTIS HC A02/MF A01 CSCL 13I

A system is described for loading newly mined material such as coal, into a shuttle car, at a location near the mine face where there is only a limited height available for a loading system. The system includes a storage bin having several telescoping bin sections, and a shuttle car having a bottom wall that can move under the bin. With the bin in an extended position and filled with coal, the bin sections can be telescoped to allow the coal to drop out of the bin sections and into the shuttle car, to quickly load the car. The bin sections can then be extended, so they can be slowly filled with more coal while awaiting another shuttle car.

NASA

N83-20399# CACI, Inc. - Federal, Arlington, Va.

TRANSPORTATION NETWORK MODELS FOR ENERGY SUPPLY ANALYSIS. VOLUME 1: EXECUTIVE SUMMARY Final Report

W H BAXTER, M. S. BRONZINI, D. R. LIMAYE, and D. M. SHERMAN Mar. 1982 57 p refs Sponsored by Electric Power Research Inst

(Contract EPRI PROJ 1219-3)

(DE82-903077, EPRI-EA-2324-VOL-1) Avail: NTIS HC A04/MF A01

Future coal transportation costs and capacities are examined within a multicommodity framework by employing a national multimodal transportation network model. The model was used to forecast energy transportation costs and to determine the impact of technology and network structure on energy transport supply. The hierarchical structure of the network model includes detailed models of individual freight operations to produce estimates of node and link delay, energy use, and cost for use in the larger network model. The model was used to route origin-destination flows through the network using a minimum path algorithm with additional features such as commodity-specific costs and an equilibrium flow algorithm. A separate railroad routing model was used which has a path selection algorithm that considers rail line ownership as a path choice determinant.

DOE

N83-20400# CACI, Inc. - Federal, Arlington, Va

TRANSPORTATION NETWORK MODELS FOR ENERGY SUPPLY ANALYSIS. VOLUME 3: TRANSPORTATION NETWORK MODEL USER'S GUIDE AND DOCUMENTATION Final Report

W. H. BAXTER, M. S. BRONZINI, T. C. HOGH, D. R. LIMAYE, and D. M. SHERMAN Mar 1982 150 p Sponsored by Electric Power Research Inst. 3 Vol

(Contract EPRI PROJ 1219-3)

(DE82-903079, EPRI-EA-2324-VOL-3) Avail: NTIS HC A07/MF A01

The transportation network model for energy supply analysis is given. Complete model documentation is provided including discussions of program logic, input and output and program use. An overview is included.

DOE

N83-22529# Westinghouse Research and Development Center, Pittsburgh, Pa.

MATERIALS RESEARCH FOR HYDROGEN-COOLED SUPERCONDUCTING POWER-TRANSMISSION LINES (SPTL).

PART 1: LIQUID HYDROGEN AS A DIELECTRIC. PART 2: SUPERCONDUCTING MATERIALS Annual Report, 1 Jan. - 31 Dec. 1981

24 Feb. 1982 127 p refs

(Contract DE-AC02-79ET-29354)

(DE83-004801; DOE/ET-29354/3) Avail: NTIS HC A07/MF A01

A system for electric breakdown and dielectric loss measurement in liquid H₂ was designed and constructed. It was shown experimentally that Nb₃Ge superconductor can be fabricated with electrical and mechanical properties suitable for use in LH₂-cooled SPTL's.

DOE

N83-22541*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DESIGN, FABRICATION AND TEST OF LIQUID METAL HEAT-PIPE SANDWICH PANELS

A. BASIULIS (Hughes Aircraft Co., Torrance, Calif) and C. J. CAMARDA Apr. 1983 9 p refs Presented at AIAA/ASME

3rd Joint Thermophys., Fluids, Plasma and Heat Transfer Conf., St. Louis, 7-11 Jun 1982. Previously announced in IAA as A82-31898

(NASA-TM-84631; NAS 1 15:84631) Avail: NTIS HC A02/MF

A01 CSCL 20D

Integral heat-pipe sandwich panels, which synergistically combine the thermal efficiency of heat pipes and the structural efficiency of honeycomb sandwich panel construction, were fabricated and tested. The designs utilize two different wickable honeycomb cores, facesheets with screen mesh sintered to the internal surfaces, and potassium or sodium as the working fluid. Panels were tested by radiant heating, and the results indicate successful heat pipe operation at temperatures of approximately 922K (1200F). These panels, in addition to solving potential thermal stress problems in an Airframe-Integrated Scramjet Engine, have potential applications as cold plates for electronic component cooling, as radiators for space platforms, and as low distortion, large area structures.

Author

N83-22786# Sandia Labs, Albuquerque, N. Mex. Experimental Facilities.

ENERGY-TRANSMISSION-SYSTEM HEAT LOSSES

R. D. MEYER Oct 1982 67 p refs

(Contract DE-AC04-76DP-00789)

(DE83-003628, SAND-82-1138) Avail: NTIS HC A04/MF A01

A series of heat loss experiments was performed to determine the relative contribution of various components in thermal energy and transport storage systems. The items evaluated include pipe insulation, control and hand valves, flex hoses, various pipe geometries, and storage tanks. These data were collected in conjunction with thermal solar energy experiments but are applicable to many other types of heat transport systems.

DOE

N83-22788# JBF Scientific Corp., Wilmington, Mass.

ASSESSMENT OF DISTRIBUTED PHOTOVOLTAIC ELECTRIC-POWER SYSTEMS Final Report

R. W. NEAL, P. F. DEDUCK, and R. N. MARSHALL Oct. 1982 377 p refs

(Contract EPRI PROJ. 1192-1)

(DE83-900566; EPRI-AP-2687) Avail: NTIS HC A17/MF A01

A methodology for assessing the potential impacts of distributed photovoltaic (PV) systems on electric utility systems, including subtransmission and distribution networks, and the application of that methodology to several illustrative examples are discussed. The investigations focused upon five utilities. Impacts upon utility system operations and generation mix were assessed using accepted utility planning methods in combination with models that simulate PV system performance and life-cycle economics. Impacts on the utility subtransmission and distribution systems were also investigated. The economic potential of distributed PV systems was investigated for ownership by the utility as well as by the

07 ENERGY STORAGE

individual utility customer Presented are the methods that were developed for the study, the approach used to define preferred PV systems that could minimize the cost of energy, quantitative results for the case studies, and conclusions based on these results DOE

07

ENERGY STORAGE

Includes flywheels, heat storage, underground air storage, compressed air, storage batteries, and electric hybrid vehicles

A83-21562

STORING ENERGY IN METAL HYDRIDES - A REVIEW OF THE PHYSICAL METALLURGY

D. G. IVEY and D. O. NORTHWOOD (Windsor, University, Windsor, Ontario, Canada) Journal of Materials Science, vol 18, Feb. 1983, p 321-347 refs

The properties of metal hydrides, which are significant in terms of their potential as a hydrogen storage medium, are discussed. Attention is given to bonding and electronic factors of metal hydrides, which, when combined with hydrogen, form saline, ionic, metallic, and covalent bonds, with the resultant materials being either solid, liquid, or gaseous. Metallic bonds are the most promising for hydrogen storage, and involve most of the elements of groups IIIA-VIIIA in the periodic table. An analysis of the thermodynamics and kinetics of metal hydrides is presented, noting the effects of alloy composition, crystal structure, and contaminants on the effectiveness of the materials as hydrides. Hysteresis has been found to occur when the transition pressure in a pressure-composition-temperature curve is higher for absorption than for desorption, although the actual causes for hysteresis are not understood. The AB group of intermetallics has been determined to store hydrogen at the lowest cost. Examples from tests using the AB compounds are outlined, and attempts to rectify storage requirement deficiencies by adjusting the alloy compositions are described. M S K

A83-22701#

STUDY ON COMPOSITE FLYWHEELS FOR ENERGY STORAGE

K. KOGAI, T. INUTAKE, A. HAMAMOTO, Y. TADAISHI, and K. KAWAMURA. Ishikawajima-Harima Engineering Review, vol 22, Sept 1982, p 297-302. In Japanese, with abstract in English refs

In order to investigate the feasibility of composite flywheels as a means of storing energy, flywheels consisting of carbon fiber epoxy rims and aluminum or carbon fabric composite hubs were designed, fabricated, and tested. The carbon fiber epoxy composite rims fabricated by the filament winding method were 380 mm in outer diameter and 300 mm in inner diameter with a thickness of 25 mm. The test rotor with an aluminum hub was spun to a maximum peripheral speed of 982 m/s on burst tests. This corresponds to an energy density, based upon the total rotor weight, of approximately 71 W h/kg. Another rotor with two aluminum hubs using a four-rim configuration was successfully tested to 800 m/s without any damage or dynamic problems. The stored energy in the rotor is more than 500 W h, and the energy density is about 55 W h/kg at 800 m/s. The rotor with a composite hub was tested to a peripheral speed of 820 m/s. It was restricted by dynamic problems in the rotor, but the energy density was about 66 W h/kg at 800 m/s due to the light weight of the hub. (Author)

A83-23132#

STORED CHEMICAL ENERGY PROPULSION SYSTEM FOR UNDERWATER APPLICATIONS

T. G. HUGHES, R. B. SMITH, and D. H. KIELY (Pennsylvania State University, University Park, PA) Journal of Energy, vol. 7, Mar-Apr. 1983, p. 128-133. Navy-sponsored research. refs (AIAA PAPER 81-1601)

An underwater propulsion system that couples a lithium fueled boiler with a standard Rankine cycle has been developed and demonstrated in an ocean environment. Although the demonstration vehicle was a small diameter axisymmetric body, other configurations have been subjected to study and experimentation. Various fuel-oxidizer combinations have been considered for use in the system, and these are examined along with the necessary supporting technologies for future development efforts. A brief history of the system development is included. It is concluded that the described system has been shown to be a viable candidate for numerous underwater applications. (Author)

A83-27151

APPLICATION OF MICROPROCESSOR-BASED CONTROLS IN AN AC/DC POWER CONVERSION SYSTEM

L. J. KOVALSKY (Westinghouse Research and Development Center, Pittsburgh, PA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p 187-192. Research sponsored by the U.S. Department of Energy refs

A description is presented of the application of a microprocessor-based control system in an ac/dc power converter (or inverter). This control system was developed as one of the tasks in a program related to the application of power converters in a utility battery storage system. The program had the objective to design a system in which the microprocessor performs the supervisory control functions of a power converter, and provides closed-loop control of voltage and current by control of the thyristor gating pulses. Attention is given to a system description, the microprocessor-controlled thyristor gating, and the microprocessor closed-loop design. The reported investigation demonstrates the potential usefulness of a microprocessor-based control in power conversion systems, and provides a good base for continued exploration of microprocessor-based products and equipment. G R

A83-27164

ENERGY UTILIZATION OF ELECTRIC AND HYBRID VEHICLES

P. D. AGARWAL and T. C. WANG (General Motors Research Laboratory, Warren, MI) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p 479-484 refs

This paper discusses energy utilization and power train efficiency of electric and electric/flywheel hybrid vehicles. Results of EVSIM (a digital simulation program) and test data obtained from a mini-computer controlled dynamometer facility are presented. It is shown that the marginal improvement of vehicle range due to regenerative braking does not justify the complexity of its controls. Similarly, while the electric/flywheel hybrid may show theoretical benefit in stop-and-go traffic, it is not an attractive and practical scheme because of added cost, complexity, and poor performance at constant speeds. (Author)

A83-27169

COMPARISON OF Na/S AND LiAl/FeS BATTERIES

R. KNOEDLER (Brown, Boveri et Cie AG, Heidelberg, West Germany) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 2. New York, Institute of Electrical and Electronics Engineers, 1982, p 552-556 refs

NaS and LiAl/FeS batteries, both promising candidates for electric-vehicle propulsion and load leveling applications, are

compared by assessing 25 different properties of each system. The most important of these properties, including the specific energy of cells and batteries, maximum specific power, lifetime, safety, key technical problems, and economic considerations, are discussed in detail. It is shown that both types of batteries qualify as high-performance batteries. The NaS system has a slight advantage for applications in West Germany (mainly electric vehicle propulsion, no Li resources), for applications in the United States (electric vehicle propulsion and load leveling), both systems are equally suitable V.L.

A83-27175

SODIUM-SULFUR BATTERY PROGRAM IN JAPAN

K. FUCHIDA, K. OKADA, S. IWABUCHI (Yuasa Battery Co., Ltd., Takatsuki, Osaka, Japan), T. YOKOYAMA, and K. NAKAHARA (New Energy Development Organization, Tokyo, Japan). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 2. New York, Institute of Electrical and Electronics Engineers, 1982, p. 591-596

An 11-year program was started in Japan in 1980 to develop new electric-energy storage systems. The advanced batteries chosen for this project are sodium-sulfur, zinc-chlorine, zinc-bromine, and Redox batteries. Here, the development of a Na/S battery is discussed. The battery consists of a series of cells containing beta-alumina tubes as electrolyte and molten sodium and sulfur as active materials. A 1kW/8kWh battery is to be built by the end of 1983. The system, if successful, will be scaled up to 10kW/80kWh by the end of 1986 and to 1MW/8MWh in 1987. The basic design features of the 1kW/8kWh battery and its expected performance characteristics are presented. V.L.

A83-27176#

LARGE NICKEL ALKALINE BATTERIES

A. HIMY (U.S. Navy, Washington, DC). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 2. New York, Institute of Electrical and Electronics Engineers, 1982, p. 597-599

Actual service data on the best commercial cells are examined to see if large batteries in the range of 2000 Ah can be built on the basis of existing technology used in cells of medium size (100-250 Ah) without further research. The systems examined are lead-acid, nickel-zinc, nickel-cadmium, nickel-iron, and silver-zinc batteries. An analysis of the data shows that of all viable systems which can be engineered in a relatively short term in the range of 2000 Ah and are capable of higher energy densities than the lead-acid battery, only the nickel-iron and nickel cadmium systems are promising and close to the imposed requirements (500 deep cycles and a 5-year life) V.L.

A83-27177*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio

DESIGN FLEXIBILITY OF REDOX FLOW SYSTEMS

N. H. HAGEDORN and L. H. THALLER (NASA, Lewis Research Center, Cleveland, OH). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 2. New York, Institute of Electrical and Electronics Engineers, 1982, p. 600-609 refs

(Previously announced in STAR as N82-31459)

A83-27302

RECENT ADVANCES IN COMPOSITE FLYWHEEL CONTAINMENT DESIGN TECHNOLOGY

A. P. COPPA (General Electric Co., Space Systems Div., Philadelphia, PA) and S. V. KULKARNI (California, University, Livermore, CA). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1930-1935. refs

Analytical correlation of composite rotor burst tests have led to the development of preliminary methods for designing containment rings and housings. A novel analysis that made the correlation possible is briefly described. This characterizes a fragmented composite rotor in terms of a constant parameter, called the apparent fragment crushing strength, which is the ability of initially released fragmentation to resist progressive breakdown under the applied containment forces. Burst-containment weight estimates based on the analysis are presented for a .25 kwh laminated glass/epoxy rotor design and several containment ring materials. Containment aspects of a loose-running, intact rotor and general flywheel housing design requirements are also discussed and a pertinent housing design concept is presented.

(Author)

A83-27303

COMPRESSION MOLDED ENERGY STORAGE FLYWHEELS

P. A. BURDICK (Owens-Corning Fiberglass Composite Development Laboratory, Granville, OH). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1936-1940 refs

Materials choices, manufacturing processes, and benefits of flywheels as an effective energy storage device are discussed. Tests at the LL Laboratories have indicated that compressing molding of plies of structural sheet molding compound (SMC) filled with randomly oriented fibers produces a laminated disk with transversely isotropic properties. Good performance has been realized with a carbon/epoxy system, which displays satisfactory stiffness and strength in flywheel applications. A core profile has been selected, consisting of a uniform 1 in cross sectional thickness and a 21 in diam. Test configurations using three different resin paste formulations were compared after being mounted elastically on aluminum hubs. Further development was found necessary on accurate balancing and hub bonding. It was concluded that the SMC flywheels display the low-cost, sufficient energy densities, suitable dynamic stability characteristics, and acceptably benign failure modes for automotive applications.

M S K

A83-27304

TWIN DISK COMPOSITE FLYWHEEL

B. R. GINSBURG (Rockwell International Corp., Rocketdyne Div., Canoga Park, CA). In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1941-1944. Research supported by Sandia National Laboratory. refs

The design criteria, materials, and initial test results of composite flywheels produced under DOE/Sandia contract are reported. The flywheels were required to store from 1-5 kWh with a total energy density of 80 W-h/kg at the maximum operational speed. The maximum diameter was set at 0.6 m, coupled to a maximum thickness of 0.2 m. A maximum running time at full speed of 1000 hr, in addition to a 10,000 cycle lifetime was mandated, together with a radial overlap in the material. The unit selected was a circumferentially wound composite rim made of graphite/epoxy mounted on an aluminum mandrel ring connected to an aluminum hub consisting of two constant stress disks. A tangentially wound graphite/epoxy overlap covered the rings. All conditions, i.e., rotation at 22,000 rpm and a measured storage of 1.94 kWh were verified in the first test series, although a second

07 ENERGY STORAGE

flywheel failed in subsequent tests when the temperature was inadvertently allowed to rise from 15 F to over 200 F. Retest of the first flywheel again satisfied design goals. The units are considered as ideal for coupling with solar energy and wind turbine systems. M S K

A83-27305#

THERMAL ENERGY STORAGE - AIR FORCE USER CONSIDERATIONS IN VARIOUS MODES OF OPERATION

D. M. ALLEN (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 1945-1948

Applications of thermal energy storage systems investigated by the USAF are described. Off-peak and peak demand reduction efforts were enacted at large bases, small nonremote locations, and base housing sites. Water cool storage in order to offset peak cooling loads was considered the preferred thermal storage medium until magnesite bricks become available in the U S. Cogeneration is regarded as primarily applicable in remote sites, where solar heating coupled with thermal energy storage is also being seriously studied. The progress of chemical heat pumps is being monitored, as are developments in aquifer energy storage and geothermal energy systems. M.S.K.

A83-27306

PROGRAM OVERVIEW AND DIESEL/FLYWHEEL HYBRID POWER TRAIN DESIGN - FIBRE COMPOSITE FLYWHEEL DEVELOPMENT PROGRAM FOR ROAD VEHICLE APPLICATIONS

R. C. FLANAGAN (Ottawa, University, Ottawa, Canada) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 1955-1960. National Research Council of Canada. Natural Sciences and Engineering Research Council of Canada.

(Contract NRC OSU-80-00043, NSERC-A-7516, NSERC-A-0440, NSERC-E-5373)

Physical criteria for an energy storage unit in a diesel-flywheel urban bus application are defined. The entire power drive train was modeled, together with component optimization considerations, using the flexible tolerance polyhedron algorithm with fuel consumption as the optimized parameter. The optimized hybrid components consisted of a 49.96 kW engine rating, 15.57 kW normal engine operating point, a driveshaft transmission rating of 141.9 kW, a flywheel transmission rating of 105.0 kW, and a flywheel energy capacity of 3523 kJ. The external system was modeled to include 1.8 m/s² acceleration, 17.88 m/sec cruise, and -2.1 m/s² deceleration, and a road route for a minibus. An Otto engine was predicted to yield 5 mpg, a diesel with continuously variable transmission 8.4 mpg, and the hybrid vehicle 12.4 mpg over the same course. M.S.K.

A83-27307

FIBRE COMPOSITE ROTOR SELECTION AND DESIGN /FIBRE COMPOSITE FLYWHEEL DEVELOPMENT PROGRAM FOR ROAD VEHICLE APPLICATIONS/

R. C. FLANAGAN, J. M. WONG, and M. B. MUNRO (Ottawa, University, Ottawa, Canada) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 1961-1966. National Research Council of Canada. Natural Sciences and Engineering Research Council.

(Contract NRC OSU-80-00043, NSERC-A-7516, NSERC-A-0440, NSERC-E-5373)

The stress patterns, working stress levels, rotor weight, geometry, and the material cost of possible flywheel designs for road vehicles are considered. The calculations are based on a 10 kWh usable energy storage and a 2:1 speed range. Decision

analysis was used to select among flywheel designs, resulting in a selection of single-material multiring-on-ring, multimaterial multiring with overwrap or bandwrap, and multimaterial multiring-on-ring configurations made of epoxy fiberglass, S2-fiberglass, Kevlar 29, Kevlar 49, and carbon fibers. Fifty-six combinations were examined, and the S2-fiberglass, carbon, and Kevlar 49 were found to be suitable for further tests to develop a manufacturing and materials data base. M.S.K.

A83-27308

MANUFACTURE AND TESTING OF FIBRE COMPOSITE ROTOR COMPONENTS /FIBRE COMPOSITE FLYWHEEL DEVELOPMENT PROGRAM FOR ROAD VEHICLE APPLICATIONS/

M. B. MUNRO, A. MIYASE, J. MCCREA, and R. C. FLANAGAN (Ottawa, University, Ottawa, Canada) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1967-1972. Natural Research Council of Canada. Natural Sciences and Engineering Research Council. refs. (Contract NRC OSU-80-00043; NSERC-A-7516, NSERC-A-0440, NSERC-E-5370)

A83-27309

THE USE OF MECHANICAL ENERGY STORAGE IN AN UNCONVENTIONAL, ROUGH TERRAIN VEHICLE

K. J. WALDRON, K. SRINIVASAN (Ohio State University, Columbus, OH), and A. A. FRANK (Wisconsin, University, Madison, WI) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 1973-1980. refs.

(Contract MDA903-82-K-0058, MDA903-82-C-0028)

The energy management system for a six-legged vehicle for transportation over rough terrain is examined. The total system comprises a gasoline engine, flywheel storage package, hydraulic transmission, and an actuation system that features computer-controlled variable displacement pumps. The legged vehicle is of interest because 50% of the earth's surface is accessible to wheeled or track vehicles, while 90% can be reached by animals moving on legs. The mammalian leg and an innovative linkage geometry were explored to improve the power-to-weight ratio. A hydraulic power transmission and actuation system were chosen to accelerate the response and simplify the drive. The gasoline engine was selected for its power density, and hydraulic flow paths and the control information paths were defined. Additional investigations are planned for the system dynamic response, the switching problems, the fluid transients, and dynamic optimization. The tests will be performed on breadboard models and computer simulations. M.S.K.

A83-27310#

ANALYSIS OF FIXED-BASE FLYWHEEL SYSTEMS FOR ELECTRIC UTILITY APPLICATIONS

M. OLSZEWSKI (Oak Ridge National Laboratory, Oak Ridge, TN) In IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1981-1986. refs.

(Contract W-7405-ENG-26)

The results of an Oak Ridge Laboratories assessment of utility peaking applications of flywheels, compressed air energy storage (CAES), and batteries in order to reduce peaking power plant fuel consumption are reported. Attention was focused on the economic aspects of peaking storage systems, with consideration given to the present worth of the annual revenue required to meet all annual operating costs and the required capital investment sequencing of alternative plans for utility plant additions. A break-even index was formulated for comparing the storage technologies. CAES was found to be presently the least cost storage option if favorable geologic conditions are available. A target cost was calculated for flywheels to become cost

competitive, resulting in a \$720/kW figure, i.e., 68% of the 1982 cost. Specific programs aimed at producing flywheels at the necessary cost are enumerated M S K.

A83-27311

FACTORS AFFECTING STORAGE OF COMPRESSED AIR IN SOLUTION MINED SALT CAVITIES

R D ALLEN, T. J. DOHERTY (Battelle Pacific Northwest Laboratories, Richland, WA), and R L THOMS (Louisiana State University, Baton Rouge, LA) In: IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 1992-1999 refs
(Contract DE-AC06-76RL-01830)

A83-27313

INCREASING SUMMER PEAK POWER WITH AQUIFER STORAGE

W J SCHAETZLE (Alabama, University, University, W J. Schaetzle and Associates, Inc., Tuscaloosa, AL) and B F. BARFIELD (Alabama, University, University, AL) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 2006-2011 refs

Design and operational features, as well as economic benefits, of an aquifer water storage system for reducing peak summer cooling loads at the condensers of power plants are described. The water would be gathered from a river or a cooling tower during the winter, injected into the aquifer, then retrieved to lessen condenser loads in the summer. The system would consist of rows of cold and warm water, with the water being transferred from one to the other in appropriate seasons. The reinjection is necessary to prevent depletion of the aquifer. Amortization of the system costs is calculated to more than displace the costs of power generation or the costs of building a peaking power plant to meet summer cooling loads. The systems are constrained to aquifer flows of less than a few feet a year and a permeability of 10 gal/day/sq ft at a gradient of 1 ft/ft. M S K.

A83-27314

AQUASTOR - A COMPUTER MODEL FOR COST ANALYSIS OF AQUIFER THERMAL ENERGY STORAGE COUPLED WITH DISTRICT HEATING OR COOLING SYSTEMS

D R BROWN, H. D. HUBER, and R W REILLY (Battelle Pacific Northwest Laboratories, Richland, WA) In: IECEC '82; Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volume 4. New York, Institute of Electrical and Electronics Engineers, 1982, p 2012-2018

A83-28666#

THE CALCULATION OF ENERGY STORAGE FLYWHEELS OF FIBER COMPOSITES WITH ELECTRIC ENERGY CONVERTER [ZUR BERECHNUNG VON SCHWUNGRADENERGIESPEICHERN AUS FASERVERBUNDWERKSTOFF MIT ELEKTRISCHER ENERGIEWANDLER]

W R CANDERS Braunschweig, Technische Universität, Fakultät für Maschinenbau und Elektrotechnik, Dr-Ing Dissertation, 1982 216 p In German Research supported by the Deutsche Forschungsgemeinschaft refs

The computation and the design of energy storage flywheels with electromechanical energy converters are considered in the present study. The most important stress parameters for flywheels of unidirectional laminate are determined, and criteria for the dimensioning of the flywheel are presented, taking into account centrifugal and compressive stresses. The required high speed of the flywheel is the dominating factor, which has to be considered also in the design of the driving engine for the storage device. The computation of the design characteristics of an outside-rotor motor with permanent-magnet excitation as an integral component of the storage device is discussed. The significance of the obtained

results is illustrated with the aid of design examples and an application example in the area of vehicular technology. G R

A83-28941

PHOTOCHEMICAL STORAGE POTENTIAL OF AZOBENZENES

J OLMSTED, III, J LAWRENCE, and G G YEE (California State University, Fullerton, CA) Solar Energy (ISSN 0038-092X), vol 30, no 3, 1983, p 271-274. refs
(Contract DE-FG02-79ER-10546)

The potential for storage of solar energy using photochemical trans-cis isomerizations of substituted azobenzenes has been studied. Polar substituents are found to red-shift the π - π^* absorption spectrum of these compounds without destroying the endothermicity of the photoisomerization. Highly red-shifted compounds such as azonaphthalenes revert thermally to the trans isomer within seconds. Methyl orange has the most favorable energy storage potential of the compounds studied and has a storage efficiency of 16 percent for 436 nm irradiation and 2 percent for AM-1 isolation. Because of limited solubilities and rapid thermal reversion rates in polar solvents, it is concluded that azobenzenes are not favorable compounds for photochemical solar energy storage. Author

A83-28969#

PERFORMANCE OF A CYLINDRICAL PHASE-CHANGE THERMAL ENERGY STORAGE UNIT

D L JACOBSON (Arizona State University, Tempe, AZ) and R PONNAPPAN AIAA Journal (ISSN 0001-1452), vol 21, May 1983, p 774-780 refs
(Contract F33615-77-C-2059)

Previously cited in issue 06, p 899, Accession no A82-17770

N83-16419*#

Jet Propulsion Lab., California Inst. of Tech., Pasadena

BASIC INVESTIGATION INTO THE ELECTRICAL PERFORMANCE OF SOLID ELECTROLYTE MEMBRANES

R. RICHTER 15 Aug 1982 37 p refs Sponsored by NASA (NASA-CR-169790, JPL-PUB-82-75, NAS 1 26 169790) Avail NTIS HC A03/MF A01 CSCL 07D

The electrical performance of solid electrolyte membranes was investigated analytically and the results were compared with experimental data. It is concluded that in devices that are used for pumping oxygen the major power losses have to be attributed to the thin film electrodes. Relations were developed by which the effectiveness of tubular solid electrolyte membranes can be determined and the optimum length evaluated. The observed failure of solid electrolyte tube membranes in very localized areas is explained by the highly non-uniform current distribution in the membranes. The analysis points to a possible contact resistance between the electrodes and the solid electrolyte material. This possible contact resistance remains to be investigated experimentally. It is concluded that film electrodes are not appropriate for devices which operate with current flow, i.e., pumps though they can be employed without reservation in devices that measure oxygen pressures if a limited increase in the response time can be tolerated. Author

N83-16858*#

Jet Propulsion Lab., California Inst. of Tech., Pasadena

TESTING OF THE EAGLE-PICHER NICKEL-IRON, THE GLOBE ISOA LEAD-ACID, AND THE WESTINGHOUSE NICKEL-IRON BATTERY SUBSYSTEMS IN AN ELECTRIC-VEHICLE ENVIRONMENT

R HEWITT and J BRYANT 15 Jul. 1982 283 p refs
(Contract DE-AI01-78CS-54209)

(NASA-CR-169801, JPL-PUB-82-91, DOE/CS-54209/10, NAS 1 26 169801) Avail: NTIS HC A13/MF A01 CSCL 10C

Three full size developmental batteries were tested with electric vehicles, two nickel-iron batteries and a lead-acid battery. Constant speed and driving schedule tests were done on a chassis dynamometer. Several aspects of battery performance were evaluated for capacity, recharge efficiency, voltage response, and

07 ENERGY STORAGE

self discharge Each of these three batteries exhibited some strengths and some weaknesses. E A K

N83-16860# Frezzolini Electronics, Inc., Hawthorne, N.J. General Research Labs. Div
SEALED MINI-NICKEL CADMIUM BATTERY CHARGING TECHNIQUES, TECHNICAL INVESTIGATION REPORT Final Report, Dec. 1980 - Dec. 1981
J CRAWFORD and R S PINKHAM Lakehurst, N J Naval Air Engineering Center 20 Sep 1982 104 p refs
(Contract N68355-81-C-0502; WF41461400)
(AD-A119826; NAEC-92-161) Avail NTIS HC A06/MF A01
CSC L 10C

The results of this effort indicate that no correlation could be established between any particular charging mode and any resulting enhanced cell capacity, all tested cells being considered. A further result was that the cells exhibited high variability of performance when compared to one which had outstanding stability under all test conditions. Further study is recommended to investigate the actual performance of batteries, using mini-nickel cadmium cells produced for field use. As a result, new standards for sealed mini-nickel cadmium cell performance should be evolved for future rechargeable battery systems. Author (GRA)

N83-16862# Trans Energy Systems, Inc., Bellevue, Wash
BELLINGHAM PHASE 3, ENGINEERING AND TECHNOLOGY DEVELOPMENT FOR A HOT-WATER DISTRICT-HEATING SYSTEM EMPLOYING THERMAL-ENERGY STORAGE
G. L VANROYEN 1981 9 p Presented at the Ann Contractor's Rev. Meeting on Thermal and Chem Storage, Tysons Corner, Va., 19 Sep 1981
(Contract W-7405-ENG-26)
(DE82-000106, CONF-810940-10) Avail NTIS HC A02/MF A01

Thermal energy storage in a district heating system which requires the integration of customer consumption rates, weather and other system operating conditions, as well as economic payback is evaluated. Generic methods of approaching and evaluating these factors are essential to insure that the most economical district heating projects are selected for development and that those systems are designed and operated in the most cost effective manner. Also, governmental and legal guidelines for interfacing with users, financing, and municipal utility regulations are examined. DOE

N83-16863# Oak Ridge National Lab., Tenn Energy Div
ELECTRIC SYSTEM IMPACTS OF STORAGE HEATING AND STORAGE WATER HEATING, PART 2
C W GELLINGS, J R REDMON, J P STOVALL, and T W REDDOCH 1981 11 p refs Presented at the IEEE/PES Conf., Minneapolis, 20 Sep 1981 Prepared in cooperation with Public Service Electric and Gas Co
(Contract W-7405-ENG-26)
(DE81-032010; CONF-810903-2) Avail. NTIS HC A02/MF A01

Primary and secondary electric distribution impacts of thermal storage heating and water heating systems are evaluated. The distribution of the impacts based on the observed load characteristics are examined. DOE

N83-16868# Utah State Univ., Logan Water Research Lab
DESIGN CONSIDERATIONS IN THE USE OF GLAUBER SALT FOR ENERGY STORAGE
D G CHADWICK and K H SHERWOOD Nov 1981 51 p refs Sponsored by DOE
(DE82-019289, UWRL/P-81/05) Avail NTIS HC A04/MF A01

Various design concepts for the utilization of the latent heat of Glauber salt at temperatures between 250 C and 500 C were studied. Consideration was given to system economics and what particular heat storage system if perfected would be most cost effective. The problems of limiting crystal size and heat transfer into and out of salt crystals is discussed. Crystal size is affected by the degree of agitation the salt solution experiences during the salt cooling process. Consequently, crystal size was moderated in a favorable way by introducing air bubbles at the bottom of the

salt container. As the bubbles rise a mixing action occurs which limits crystal size and helps prohibit the accumulation of an anhydrous sludge that settles out of solution in the freezing thawing process. DOE

N83-16869# Sargent and Lundy, Engineers, Chicago, Ill.
COMPRESSED-AIR ENERGY STORAGE PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AN AQUIFER. VOLUME 3, PART 1: SITE SELECTION STUDY Final Report
Sep 1982 124 p refs Sponsored by Electric Power Research Inst. Prepared in cooperation with Public Service Co of Indiana, Inc., Plainfield
(Contract DE-AC02-78ET-29232; ET-78-C-01-2159; EPRI PROJ. 1081-3)
(DE82-001251; EPRI-EM-2351-VOL-3-PT-1) Avail: NTIS HC A06/MF A01

The site selection study aspects of an aquifer based compressed air energy storage facility. Aquifer sites in the Illinois and Indiana portions of the Illinois Basin were identified and ranked. A site was selected from the four top ranked sites and was then utilized in other project work as the host site for the preliminary design of a compressed air energy storage facility. DOE

N83-16875# Oak Ridge National Lab., Tenn Chemistry Div
PHYSICAL CHEMISTRY OF MOLTEN-SALT BATTERIES. CURRENT-INDUCED COMPOSITION GRADIENTS IN MOLTEN LiCl-KCl Final Report, 1 Oct. 1980 - Sep. 1981
C. E VALLET, D E HEATHERLY, and J BRAUNSTEIN Oct 1982 20 p refs
(Contract W-7405-ENG-26)
(DE83-001684, ORNL/TM-8489) Avail NTIS HC A02/MF A01

Current induced composition gradients were predicted in mixed molten salt battery electrolytes. Composition shifts, if large enough, can produce significant deleterious effects, such as solid phase precipitation in or near the electrodes of molten salt batteries, including the LiAl/LiCl-KCl/Fe-S sub x battery. Quantitative measurements are needed to determine the extent of the gradients and to find means to reduce them. The first quantitative scanning electron microscopy/X ray fluorescence (SEM/EDX) measurements with high distance resolution (50 (SIGMA) m) of the shape of the composition profile in LiCl-KCl electrolyzed between LiAl electrodes is given. Also, current induced precipitation of LiCl in a porous LiAl anode is indicated by SEM/EDX examination. The measured compositions are consistent with predictions from mass transport models based on the electrode reactions, migrational and diffusional mobilities. DOE

N83-16899# EIC, Inc., Newton, Mass
INVESTIGATION OF INTERCALATED COMPOUNDS FOR PHOTOELECTROCHEMICAL ENERGY STORAGE Final Report, 23 Feb. 1981 - 22 Feb. 1982

R. D RAUH Jul 1982 52 p refs Prepared in cooperation with California Univ., Lawrence Berkeley Lab
(Contract DE-AC03-76SF-00098)
(DE83-000543, LBL-14794) Avail. NTIS HC A04/MF A01

Layered chalcogenides of general formula MX₂ were investigated for the storage of electrical energy generated by photoelectrochemical solar cells. These storage materials are economical and have excellent volumetric energy densities which allows direct incorporation into flat plate photovoltaic modules. Two approaches were evaluated (1) intercalation electrodes such as Cu/sub x/TiS₂ which can be charged by a separated regenerative photoelectrochemical cell; and (2) active photointercalation/photodeintercalation cells in which the storage step is effected directly by irradiating a layered semiconducting photoelectrode. DOE

N83-16918# General Electric Co., Schenectady, N. Y. Advanced Energy Programs Dept

DEVELOPMENT OF ADVANCED BATTERIES FOR UTILITY APPLICATION Final Report, 1 Jun. 1979 - 15 Jun. 1981

J A BAST and S P MITOFF Sep. 1982 250 p refs (Contract EPRI PROJ. 128-6)

(DE82-906459; EPRI-EM-2579) Avail: NTIS HC A11/MF A01

The development of Beta (sodium-sulfur) batteries for utility load leveling applications is discussed. A cell that is cost effective in the battery configuration for utility application was designed. The cell electrolyte is a beta"-alumina ceramic, change was made from beta alumina to beta"-alumina in the electrolyte. The ceramic composition and the process of the internal seal were developed. Generation VIII beta"-alumina shows no asymmetric polarization, relatively low aging rates, no corrosion on the sulfur side, and substantially less blackening than other beta"-alumina tubes. Chromized steel container materials with duplex coating consistently shows excellent performance. Cells with beta"-alumina, which achieve life of 752 Ah/cm(2) are tested. DOE

N83-16919# United Technologies Corp., East Hartford, Conn. **EVALUATION OF INDUSTRIAL ADVANCED HEAT RECOVERY/THERMAL ENERGY STORAGE SYSTEMS Final Report**

H R MCCHESENEY, R. W BASS, A M LANDERMAN, T N. OBEE, and C T SGAMBOTI Sep. 1982 66 p (Contract EPRI PROJ. 1275-1)

(DE82-906475; EPRI-EM-2573-VOL-1-EXEC-SUMM) Avail: NTIS HC A04/MF A01

The investigation has involved: examining plant and process energy data acquired during on-site visits to 12 industrial plants from which 24 candidate applications were identified where thermal energy storage (TES) would be necessary either to make possible or to enhance the recovery and reuse of industrial waste heat; compiling cost and performance data for commercially available (1985) equipment to recover, store, and transfer waste heat between source and sink processes on demand and assessing the economic benefits, possible energy savings, and utility impact if proposed systems were installed and operated in industrial plants. DOE

N83-16933# Commission of the European Communities, Luxembourg.

INVESTIGATION OF LATENT HEAT STORAGE MATERIALS IN THE MEDIUM AND HIGH TEMPERATURE RANGE Final Report

D HEINE, F HEES, and D STEINER Aug 1982 87 p refs Transl into ENGLISH of the mono "Untersuchung von Mittel- und Hochtemperaturlatentwaermespeicher-Materialien" Brussels, Commission of the European Communities, 1981 p 1-95 Prepared in cooperation with Inst fuer Kerntechnik und Energiewandlung e V, Stuttgart, West Germany

(PB82-259896; EUR-7065-68) Avail: NTIS HC A05/MF A01 CSCL 10C

Experimental investigations are carried out of the long term behavior of latent heat storage materials for use in the temperature ranges 200 to 450 degrees C and 700 to 900 degrees C. These investigations comprise the corrosion of structural materials together with promising storage materials and the thermal stability and the melting and freezing behavior of these storage materials. From the corrosion tests the mass loss of sheet metal samples is measured and thickness reduction and corrosion rate are calculated. Furthermore the corrosion type is determined using optical and scanning electron microscopes. During cyclic tests melting and freezing curves are continually measured. Thereby the thermal stability of the storage materials as a function of melting and freezing is determined. GRA

N83-16934# Accumulation-Fabrik A G., Soest (West Germany). **BIPOLAR LEAD ACCUMULATOR CELL WITH HIGH ENERGY DENSITY Report, Aug. 1978 - Nov. 1980**

R. KIESSLING Aug 1982 83 p refs Transl. into ENGLISH of the mono. "Bipolare Bleiakkumulatorenzelle hoher Energiedichte" West Germany, Nov. 1980. Sponsored by Bundesministerium fuer Forschung und Technologie (PB82-258757; BMFT-FB-T-80-115) Avail: NTIS HC A05/MF A01 CSCL 10C

A cell design using bipolar electrodes was proposed for increasing the energy density of the familiar PbO₂/H₂SO₄/Pb system. Weight reductions have been achieved by improving several details of the battery construction and grid design, and reducing the amount of electrolyte. Requirements for low-maintenance have been equally fulfilled by reducing water consumption. Lead-coated Cu was chosen for the grid of the negative electrode and lead-coated Al for the grid of the positive electrode. An 80 to 100 micrometers lead-coating was found to offer sufficient protection for the Cu-grid because anodic corrosion of the negative electrode could be discounted. Cu itself, in contact with negative active material remains stable with the normal range of electrochemical potential. Al, as the positive grid, required a protective lead-coating of at least 250 micrometers, without pinholes or other defects or anodic corrosion could be intense. DOE

N83-16949# Commission of the European Communities, Luxembourg

INVESTIGATION AND DEVELOPMENT OF SYSTEMS FOR THE STORAGE OF THERMAL ENERGY IN THE TEMPERATURE RANGE FROM -25 DEG C TO +150 DEG C Final Report

P ECKERLIN, A. KLOPFER, and J SCHROEDER Aug. 1982 143 p refs Transl. into ENGLISH of "Untersuchung und Entwicklung von Systemen zur Speicherung Thermischer Energie im Temperaturbereich Zwischen -25 C und +150 C" Philips G m b H, Aachen, 1980

(PB82-255258; EUR-6936) Avail: NTIS HC A07/MF A01 CSCL 10B

Water, some salt hydrates and eutectic mixtures of the two with high heats of fusion and melting points between -50 and +130C were studied for the purpose of storing low-grade heat in residential energy systems. About 30 of these were selected and flexible flat-plate storage containers specially developed for them performed well over long periods in the laboratory. Over 30 reversible chemical reactions were also studied, all but one based on gas/solid or gas/liquid interaction. Chemical heat pump systems using heat from ambient air or soil were also studied. A system with moist soil as a storage medium surrounded by a layer of dry earth or foam insulation was discussed. GRA

N83-16950# Deutsche Automobilgesellschaft m.b.H., Esslingen (West Germany).

DEVELOPMENT OF GAS-PHASE METALLIZED PLAQUES FOR ELECTRODES OF STORAGE BATTERIES, IN PARTICULAR FOR NICKEL OXIDE ELECTRODES Final Report

R LINKOHR and H. SCHLADITZ Aug 1982 75 p refs Transl into ENGLISH of "Entwicklung von Gasphasenmetallisierten Feruestkoerpern fuer Elektroden Alkalischer Batterien, Insbesondere von Nickeloxid-Elektroden" Jun 1981 87 p Sponsored by Bundesministerium fuer Forschung und Technologie

(PB82-255431; BMFT-FB-T-81-053) Avail: NTIS HC A04/MF A01 CSCL 10B

Nickel oxide-electrode plaques for alkaline batteries have been developed by carbon vapor deposition plating fiber plaque substrates with nickel from nickelcarbonyl. Carbon felt proved to be a suitable substrate and large (22 x sq 15 sq cm) and thick 3 - 5 mm) plaques could be made from this material. Three metallization devices were constructed, one of which allowed continuous processing with carbonyl gas flowing through the felt; this improved evenness of nickel distribution. The physical properties of the plaques - structure, electric resistance, heat conduction, gas permeation - approximated by simple models and

07 ENERGY STORAGE

the corresponding calculations were compared with measurements. Nickel oxide electrodes were made from the plaques and were cycled in half-cell arrangements. The project goals concerning nickel sayings, capacity per unit area and current capability were reached. GRA

N83-18045# Pacific Northwest Lab, Richland, Wash.

COST OF HEAT FROM A SEASONAL SOURCE

R. W. REILLY, D. R. BROWN, and H. D. HUBER 1981 10 p
Presented at the Intern Energy Storage Conf., Seattle, 19 Oct 1981

(Contract DE-AC06-76RL-01830)

(DE82-006026, PNL-SA-9891, CONF-811066-7) Avail. NTIS HC A02/MF A01

Results are reported of an investigation to estimate the cost of aquifer thermal energy storage (ATES) from a seasonal heat source. The cost of supplying energy (hot water) from an ATES system is estimated. Three types of loads are investigated: point demands, residential developments, and a multidistrict city. Several technical and economic factors are found to control the economic performance of an ATES system. Costs are found to be prohibitive for systems of small size, long transmission distances, and employing expensive purchased thermal energy. ATES is found to be cost-competitive with oil-fired and electric hot water delivery systems under a broad range of potential situations. DOE

N83-18074# Sargent and Lundy, Engineers, Chicago, Ill.

COMPRESSED-AIR ENERGY STORAGE: PRELIMINARY DESIGN AND SITE-DEVELOPMENT PROGRAM IN AN AQUIFER. VOLUME 3: SITE-SELECTION STUDY, PART 2 Final Report

Sep 1982 347 p refs Prepared in cooperation with Public Service Co of Indiana Sponsored by EPRI

(Contract DE-AC02-78ET-29232; ET-78-C-01-2159; EPRI PROJ. 1081-3)

(DE83-001252; EPRI-EM-2351-VOL-3-PT-2) Avail: NTIS HC A15/MF A01

The behavior and suitability of an aquifer based compressed air energy storage (CAES) facility was investigated. Aspects of the site selection were studied. Aquifer sites in the Illinois and Indiana portions of the Illinois Basin were identified and ranked. A site was selected from the four top ranked sites and was utilized as the host site for the preliminary design of a compressed air energy storage facility. DOE

N83-18591# Los Alamos Scientific Lab., N. Mex. Technology Assessment Group

IMPACT OF FLYWHEEL-ENERGY-STORAGE TECHNOLOGY UPON TAXICAB FLEET OPERATION IN A LARGE METROPOLITAN CITY

M. C. KRUPKA and S. V. JACKSON 1981 12 p refs Presented at the 4th Intern. Conf on Alternative Energy Sources, Miami Beach, Fla., 14-16 Dec. 1981

(Contract W-7405-ENG-36)

(DE82-002371; LA-UR-81-3071; CONF-811212-2) Avail: NTIS HC A02/MF A01

The incorporation of flywheel energy storage systems (FESS) into automotive vehicles has been under consideration for some time. Previous studies have suggested that FESS can yield substantial benefits in automotive vehicle operation, particularly for urban driving. An assessment of the impacts resulting from incorporation of FESS into automotive fleets in a large metropolitan city is described. Specifically, the case of taxicab fleet operation within New City is examined. Unique features of taxicab fleets are noted and taxicab operational characteristics within New York City are detailed. Based upon available New York City operational data, a levelized life-cycle cost comparison between a standard internal combustion engine vehicle (ICEV) in present use as a taxicab and a projected FESS/ICEV taxicab is generated. Energy-savings and environmental benefits are discussed, and potential institutional barriers to FESS implementation are identified. DOE

N83-18904# National Bureau of Standards, Washington, D.C. National Measurement Lab

PHYSICAL PROPERTIES DATA COMPILATIONS RELEVANT TO ENERGY STORAGE. PART 5: MECHANICAL PROPERTIES DATA ON ALLOYS FOR USE IN FLYWHEELS

H. M. LEDBETTER 1982 38 p refs

(PB82-232919, NSRDS-NBS-61-PT-5, LC-81-14053) Avail: NTIS HC A03/MF A01 CSCL 11F

The physical and mechanical properties of twenty-one commercial alloys that are candidates for flywheel rotors used as inertial-energy-storage are described. Based metals include aluminum, iron and titanium. Alloys vary in complexity from simple carbon steels to superalloys. Properties include mass density, Young's modulus, shear modulus, bulk modulus, Poisson's ratio, yield strength, ultimate strength, fatigue strength, fracture toughness, and creep strength. Property values were collected from many types of sources and were analyzed statistically to detect possible outlying values. For each alloy, there is given typical chemical composition, typical heat treatment, metallurgical descriptions, and typical property values. GRA

N83-19277# IAP Research, Inc., Dayton, Ohio.

REPETITIVE SWITCHING FOR INDUCTIVE ENERGY STORAGE Final Technical Report, Apr. 1981 - Jun. 1982

J. P. BARBER and T. J. TRZASKA Wright-Patterson AFB, Ohio AFWAL Aug 1982 47 p refs

(Contract F33615-81-C-2024; AF PROJ 3145)

(AD-A121029; IAP-TR-82-2, AFWAL-TR-82-2088) Avail: NTIS HC A03/MF A01 CSCL 09A

This report describes the development and testing of a high current repetitive switch. The objective was to develop a switch capable of repetitively diverting current and energy from an inductive energy store into a load. A mechanical switch employing sliding electrical contacts was built and tested. The switch demonstrated performance exceeding design goals. In an inductive energy storage circuit the switch successfully commutated a current of 7640 A at a repetition rate of 33 Hz. The switch has been operated at repetition rates ranging from 1 Hz to 49 Hz. Over 1600 successful commutations have been achieved with no failures. Author (GRA)

N83-19308# National Bureau of Standards, Washington, D.C. Center for Building Technology

AN EVALUATION OF HYDRATED CALCIUM ALUMINATE COMPOUNDS AS ENERGY STORAGE MEDIA

J. B. INGS and P. W. BROWN Jun 1982 17 p refs Sponsored in part by DOE

(PB82-249921, NBSIR-82-2531) Avail: NTIS HC A02/MF A01 CSCL 10C

Calcium aluminate hydrates and calcium aluminate hydrates containing other ions were investigated to determine the feasibility of their utilization as energy storage media. A series of these compounds were fabricated and analyzed for purity. The energy liberated on hydration of each compound was measured using conduction calorimetry and the dehydration temperature was measured using differential scanning calorimetry. Author (GRA)

N83-20359*# Charles River Associates, Inc., Boston, Mass

STUDY TO ESTABLISH COST PREDICTIONS FOR THE PRODUCTION OF REDOX CHEMICALS Final Report

P. R. AMMANN, M. LORETH, and W. W. HARVEY Jul 1982 61 p refs

(Contract DEN3-251; DE-AI04-80AL-12726)

(NASA-CR-167882; DOE/NASA/0251-1, NAS 1.26 167882)

Avail: NTIS HC A04/MF A01 CSCL 10A

The chromium and iron chloride chemicals are significant first costs for NASA Redox energy storage systems. This study was performed to determine the lowest cost at which chromium and iron chlorides could be obtained for a complex of redox energy storage systems. In addition, since the solutions gradually become intermixed during the course of operation of Redox units, it was an objective to evaluate schemes for regeneration of the operating solutions. Three processes were evaluated for the production of

chromium and iron chlorides. As a basis for the preliminary plant design and economic evaluation, it was assumed that the plant would produce about 25,000 tons of contained chromium as CrCl_3 and an equivalent molar quantity of FeCl_2 . Preliminary plant designs, including materials and energy balances and sizing of major equipment, were prepared, and capital and operating costs were estimated. Author

N83-20375# Arizona State Univ., Tempe
ANALYTICAL AND EXPERIMENTAL INVESTIGATIONS OF SODIUM HEAT PIPES AND THERMAL ENERGY STORAGE SYSTEMS Final Report, Oct. 1980 - Sep. 1981
 D JACOBSON Wright-Patterson AFB, Ohio AFWAL Jan 1982 213 p refs
 (Contract F33615-77-C-2059, AF PROJ 2308)
 (AD-A122093; AFWAL-TR-81-2112) Avail: NTIS HC A10/MF A01 CSCL 13A

Eight work elements for FY 1981 are reported on. A brief evaluation of the limits of arterial heat pipes is presented followed by the post life examination of two Inconel 600, sodium heat pipes which failed by pin hole corrosion through the evaporator. Nearly 12,000 hours of operation was sustained by one of the heat pipes prior to failure. A parametric test station for a thermal train including a 15-foot Inconel 617-sodium heat. A secondary sodium heat pipe with integral LiF thermal energy storage capsules and a sodium thermal transfer joint is discussed. A series of fifteen 18-in long by 0.5 in diameter Inconel 617, sodium heat pipes are being prepared for parametric and life tests. A 12-in. long, 1-in diameter Inconel 617 container filled with the thermal energy storage salt $64\text{LiF} \cdot 30\text{MgF}_2 \cdot 6\text{KF}$ was tested to determine latent heat of fusion (782 J/gm), melting point (710 C), freezing point (671 C) and diffusivity (0.00799 sq cm/sec) of the salt. The post life test results of a series of nine salt-Inconel 600 capsules, including LiF-MgF_2 , $\text{LiF-MgF}_2 \cdot \text{KF}$, and $\text{LiF-MgF}_2 \cdot \text{NaF}$ are presented. A 321 stainless steel, sodium heat pipe containing three LiF thermal energy storage units has a total of over 10,700 hours of operation and 3426 cycles of life testing. GRA

N83-20376# Army Electronics Research and Development Command, Fort Monmouth, N. J.
HIGH-CYCLE-LIFE, HIGH-ENERGY-DENSITY NICKEL-ZINC BATTERIES
 O. C. WAGNER Feb. 1982 102 p refs
 (Contract DE-A102-80CH-10064)
 (DE82-012896; DOE/CH-10064/5, REPT-5) Avail: NTIS HC A06/MF A01

The ERADCOM nickel-zinc program, resulted in the development of 5 ampere-hour nickel-zinc cells that maintained 79% to 86% of initial capacity after 650 cycles on the C/3 80% DOD cycling regime. One cell is still delivering 70% of initial capacity after 880 cycles. This achievement is primarily due to the employment of an interrupted current (IC) charging mode on every cycle, the optimum frequency being 5 to 8 Hertz at a rest-to-pulse-ratio of 3/1, with charge control being by means of a GRL pressure switch attached to each cell at a cutoff pressure of 8 psig, and venting means at 10 psig. Design and performance characteristics of the battery are reported. DOE

N83-20380# Rocket Research Corp., Redmond, Wash
SULFURIC ACID/WATER CHEMICAL HEAT PUMP/CHEMICAL ENERGY STORAGE, PHASES 1 AND 2, PHASES 3 AND 4 Final Report, Oct. 1979 - Jan. 1982
 Apr 1982 281 p
 (Contract DE-AC02-76CH-00016)
 (DE83-001255; BNL-51540) Avail: NTIS HC A13/MF A01

The sulfuric acid/water chemical heat pump/chemical energy storage (CHP/CES) concept was expanded to include previously unexplored applications, the most notable of which is the industrial chemical heat pump. It is shown that the CHP/CES application has the greatest near term commercialization potential in the form of a temperature amplification system. Another configuration, the HVAC system with or without diurnal storage was selected for further study. A verification test unit was designed which is capable

of demonstrating operation as an ICHP as well as an HVAC system. The VTU was fabricated and tested with a nominal power rating of 150,000 Btu/hr. Testing of the unit operational performance in the industrial waste heat upgrade mode is tested. DOE

N83-20430# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering
DESIGN OF PLYWOOD AND PAPER FLYWHEEL ROTORS Final Report
 A. G. ERDMAN, D. L. HAGEN, and S. A. GAFF May 1982 133 p refs
 (Contract W-7405-ENG-48)
 (DE83-002276, UCRL-15504) Avail: NTIS HC A07/MF A01

Technical and economic design factors of cellulosic rotors are compared with conventional materials for stationary flywheel energy storage systems. Wood species, operation in a vacuum, assembly and costs of rotors are evaluated. Wound kraft paper, twine and plywood rotors are examined. Two hub attachments are designed. Support stiffness is shown to be constrained by the material strength, rotor configuration and speed ratio. Preliminary duration of load tests was performed on vacuum dried hexagonal birch plywood. Dynamic and static rotor hub fatigue equipment is designed. Moisture loss rates while vacuum drying plywood cylinders were measured, and the radial and axial diffusion coefficients were evaluated. Diffusion coefficients of epoxy coated plywood cylinders were also obtained. Economics of cellulosic and conventional rotors were examined. Plywood rotor manufacturing costs were evaluated. The optimum economic shape for laminated rotors is shown to be cylindrical. Vacuum container costs are parametrically derived and based on material properties and costs. Containment costs are significant and are included in comparisons. The optimum design stress and wound rotor configuration are calculated for seventeen examples. Plywood rotors appear to be marginally competitive with the steel hose wire or E glass rotors. High performance oriented kraft paper rotors potentially provide the lowest energy storage costs in stationary systems. DOE

N83-20432# Oak Ridge National Lab., Tenn.
NEW PHYSICAL-CHEMICAL REACTIONS USEFUL FOR TES
 J. S. JOHNSON, JR. and C. G. WESTMORELAND 1982 5 p refs
 Presented at the Energy Storage Contractors Rev. Meeting, Arlington, Va., 23 Aug. 1982
 (Contract W-7405-ENG-26)
 (DE82-020807; CONF-820827-11) Avail: NTIS HC A02/MF A01

New options in materials for heat storage is the aim of the program. Chemical systems, including those having equilibria with high temperature coefficients, are tested by differential scanning calorimetry for evidence of enhanced heat capacity. The approach is high-risk and exploratory, and in the search for new classes of storage systems, relatively little weight is given the costs of members of the classes that are at present apparent. Several possibilities have been tested in a preliminary way. These include concentrated aqueous solutions of a hydrolyzable metal ion; aqueous solutions of polyethylene oxide-polypropylene oxide polymers, which when cross-linked take up or eject water in temperature cycles, and soluble partially fluorinated organic compounds, in hope that hydrates might be formed and be melted in temperature ranges of interest (analogous to clathrates). Certain petroleum ester waxes have also been tested. No promising embodiments have been found so far, but the survey is too incomplete as yet to rule any out. DOE

N83-21527# Rockefeller Univ., New York
SOME BASIC RESEARCH PROBLEMS RELATED TO ENERGY
 1982 10 p refs
 (Contract DE-AC02-81ER-10807)
 (DE83-003753; DOE/ER-10807/7) Avail: NTIS HC A02/MF A01

The prediction and evaluation of thermophysical data of fluids and fluid mixtures are discussed. Models which calculate the transport properties of fluid mixtures according to their dependence on size and mass of the constituent particles are discussed. The application of nonlinear evolution equations to energy related

07 ENERGY STORAGE

processes is discussed. It is expected that the remarkable progress in this field will have significant practical uses. DOE

N83-21528# Pacific Northwest Lab., Richland, Wash
CAESCAP: A COMPUTER CODE FOR COMPRESSED-AIR ENERGY-STORAGE-PLANT CYCLE ANALYSIS

J. A. FORT Oct 1982 84 p refs
(Contract DE-AC06-76RL-01830)
(DE83-003146, PNL-4486) Avail: NTIS HC A05/MF A01

The analysis code, CAESCAP, was developed as an aid in comparing and evaluating proposed compressed air energy storage (CAES) cycles. Input consists of component parameters and working fluid conditions at points along a cycle. The code calculates thermodynamic properties at each point and then calculates overall cycle performance. Working fluid capabilities include steam, air, nitrogen, and parahydrogen. The CAESCAP code was used to analyze a variety of CAES cycles. The combination of straightforward input and flexible design make the code easy and inexpensive to use. DOE

N83-21574# General Electric Co., Philadelphia, Pa. Space Systems Div

ENERGY-STORAGE-FLYWHEEL HOUSING-DESIGN-CONCEPT DEVELOPMENT

A. P. COPPA Sep 1981 236 p refs
(Contract W-7405-ENG-48)
(DE82-014494; UCRL-15448) Avail: NTIS HC A11/MF A01

A low cost vehicular flywheel housing conceptual design was obtained by resorting to well developed mass production sheet metal fabrication processes and inexpensive materials. Two versions of the design, based on different rotor sizes, are described. The rotors are of the General Electric hybrid type and have the following dimensions: 15 in OD x 1.50 in. thickness and 18 in. OD x 1.00 in. thickness. Both rotors have a maximum operating energy capacity of 0.25 kw. hr and close to identical weight and energy density values of 16.0 lb. and 15.6 whr/lb respectively. A leading mass producer of sheet metal components for automotive vehicles provided budgetary quotations for steel housings. Information is included on: the design analysis, results of rotor burst testing and the conceptual design requirements for containment vacuum, safe response to vehicle collision, noise suppression, and structural performance. DOE

N83-21580# Middle South Services, Inc., New Orleans, La.
PRELIMINARY DESIGN STUDY OF COMPRESSED-AIR ENERGY STORAGE IN A SALT DOME. VOLUME 6: CAES PLANT DESIGN Final Report

Apr. 1982 215 p
(Contract DE-AC01-77ET-29332, EPRI PROJ 1081-2)
(DE82-014355; EPRI-EM-2210-VOL-6) Avail: NTIS HC A10/MF A01

The preliminary plant design for a compressed air energy storage (CAES) plant is presented. The design is based upon the facility criteria; the specific site; and the systems, subsystems. The compressed air is stored in two solution mined caverns in the salt dome. The details concerning the major equipment and the operation of the mechanical systems are described. The project schedule from start of licensing to commercial operation is estimated to be 70 months, with actual construction (including dewatering of the caverns) estimated for 39 months. Based on the cost estimate developed in this task and the modified financial data and fuel cost projections, the economic introduction of CAES into the MSS system was examined for the No. 2 oil-fired plant. The economic analysis did not extend beyond the year 1988. The economic introduction of CAES in the MSS system before 1990 is unlikely because the older oil fired units in the MSS system may be economically used for cycling and peaking, if required. For a system with a different composition of generating units, CAES may be economical at an earlier date. DOE

N83-21624# Wisconsin Univ., Madison. Engineering Experiment Station.

SUPERCONDUCTIVE ENERGY STORAGE Final Report, 1 Jan. 1976 - 30 Sep. 1981

R. W. BOOM 30 Sep. 1982 43 p refs
(Contract DE-AC02-76ET-26602)
(DE83-002270, DOE/ET-26602/35) Avail: NTIS HC A03/MF A01

Superconductive Magnetic Energy Storage (SMES) research and development for DOE from 1976-1981 has advanced the design of SMES from one deep tunnel to a 15 tunnel hour-glass design to the present low aspect ratio surface trench large diameter storage solenoid. This final report, which refers to all previous detailed reports and publications, concentrates on the last design of 1981, the low aspect ratio design. The SMES project is an ongoing project which includes the continuous development of designs and components. This report describes conceptual designs and the current state of development for the conductor, struts and cryogenics. Two companion efforts, rock mechanics and electrical systems, have been supported by the Wisconsin Utilities and are given less coverage here, although many references are listed in the 176-item bibliography. The present state of the project is that \$15 million dollars is needed to take the next step. The work to be done is to improve the design, complete the component developments, design and test fabrication equipment and undertake credible cost estimates. DOE

N83-21629# Reynolds Metals Co., Richmond, Va. Dept of Applied Chemistry and Physics.

EFFECT OF MANGANESE ADDITIONS ON THE PERFORMANCE OF ALUMINUM AIR-BATTERY ANODE ALLOYS Progress Report

D. H. SCOTT 5 May 1982 43 p
(Contract W-7405-ENG-48)
(DE83-002277, UCRL-15473; MR-82-14) Avail: NTIS HC A03/MF A01

Electrochemical evaluation of the experimental alloys previously cast indicated that the coulombic efficiency of an aluminum anode alloy with a nominal chemistry of 0.04% Fe, 0.04% Ga, and 0.8% Mg could be substantially improved by a 0.04% Mn addition. More recent electrochemical testing of ingot sections showed that the performance of an aluminum anode alloy, based on a nominal 0.04% Fe, could be improved by a high temperature homogenization. Based on these results, it was decided that the addition of manganese offered a very fruitful approach for providing improved anode performance. Thus the intent of the current work was to further investigate the effects of varying manganese/iron ratios and fabrication practices on the electro-chemical performance of an aluminum anode alloy containing a nominal 0.04% Fe. Results are presented and discussed. DOE

N83-21639# Minnesota Univ., Minneapolis. Dept of Mechanical Engineering.

FUNDAMENTAL HEAT-TRANSFER PROCESSES RELATED TO PHASE-CHANGE THERMAL-STORAGE MEDIA

E. M. SPARROW Dec 1982 12 p
(Contract DE-AC02-79ER-10343)
(DE83-002205, DOE/ER-10343/04) Avail: NTIS HC A02/MF A01

Research performed on fundamental heat transfer processes which occur in phase-change thermal storage systems is described. The research encompasses both freezing and melting, and includes both experiment and analysis. The experimental portion of the work in progress is concerned with phase change which occurs within a closed cylinder or tube. In separate but interrelated freezing and melting experiments, the effect of the inclination of the tube in the gravity field was investigated. For freezing, it was found that despite local variations, the global (i.e., surface-averaged) freezing rate was virtually independent of the inclination of the tube. On the other hand, for melting, different regimes characterized by different melting rates were encountered as a function of the tube inclination. The rate of melting is least when the tube is vertical. At moderate angles relative to the vertical, gravity presses

the melting solid against the tube, thereby accelerating the rate at which melting occurs DOE

N83-21640# Pacific Northwest Lab, Richland, Wash.
ANALYTICAL MODELING OF A HYDRAULICALLY-COMPENSATED COMPRESSED-AIR ENERGY-STORAGE SYSTEM

C. A. MCMONAGLE and D. S. ROWE (Rowe and Assoc., Inc.)
 Dec 1982 75 p refs
 (Contract DE-AC06-76RL-01830)
 (DE83-005708, PNL-3374) Avail: NTIS HC A04/MF A01

A computer program was developed to calculate the dynamic response of a hydraulically-compensated compressed air energy storage (CAES) system, including the compressor, air pipe, cavern, and hydraulic compensation pipe. The model is theoretically based on the two-fluid model in which the dynamics of each phase are presented by its set of conservation equations for mass and momentum. The conservation equations define the space and time distribution of pressure, void fraction, air saturation, and phase velocities. The phases are coupled by two interface equations. The first defines the rate of generation (or dissolution) of gaseous air in water and can include the effects of supersaturation. The second defines the frictional shear coupling (drag) between the gaseous air and water as they move relative to each other. The relative motion of the air and water is, therefore, calculated and not specified by a slip or drift-velocity correlation. The total CAES system is represented by a nodal arrangement. The conservation equations are written for each nodal volume and are solved numerically. DOE

N83-22758# Westinghouse Electric Corp., Concordville, Pa. Combustion Turbine Systems Div.
COMPRESSED-AIR ENERGY STORAGE PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AN AQUIFER. VOLUME 5, PART 2, APPENDIX F: DYNAMIC SYSTEM COMPUTER MODEL Final Report
 P. A. BERMAN, J. S. BONK, W. F. KOBETT, N. S. KOSANOVICH, L. J. LONG, and D. J. MARINACCI Nov 1982 508 p
 (Contract DE-AC02-78ET-29232, EPRI PROJ. 1081-3)
 (DE83-004004, EPRI-EM-2351-VOL-5-PT-2) Avail: NTIS HC A22/MF A01

The turbomachinery design was addressed as part of a study which examined an aquifer based compressed air energy storage (CAES) plant. The computer program and subroutines written to provide a general purpose modeling tool for a CAES power plant system are documented. The CAES plant was modeled using FORTRAN and a Control Data Corporation 7600 digital computer. The system model was developed to determine the transient response characteristics of the complete CAES plant; provide a tool for evaluating the requirements and performance of control systems proposed for the CAES plant; provide a general purpose digital computer based dynamic modeling tool, and provide power plant component models as FORTRAN subroutines that can be used, with appropriate parameter data, as modules in complete CAES power plant models. DOE

N83-22759# Westinghouse Electric Corp., Concordville, Pa. Combustion Turbine Systems Div.
COMPRESSED-AIR ENERGY STORAGE PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AN AQUIFER. VOLUME 5, PART 1: TURBOMACHINERY DESIGN Final Report
 P. A. BERMAN, J. S. BONK, W. F. KOBETT, N. S. KOSANOVICH, L. J. LONG, and D. J. MARINACCI Nov 1982 564 p
 (Contract DE-AC02-78ET-29232, EPRI PROJ. 1081-3)
 (DE83-004005, EPRI-EM-2351-VOL-5-PT-1) Avail: NTIS HC A24/MF A01

The development of the design approach for a combustion turbine heat cycle and the major mechanical equipment for use by an electric utility at a selected aquifer air storage site is documented. A compressed air energy storage (CAES) system utilizes off peak electric power, available from base load power plants, to store compressed air underground in an aquifer. During

subsequent periods, the stored air is extracted from the aquifer and used as an air supply for a generating combustion turbine expander. The aquifer has an initial discovery pressure of 840 psia. An initial air injection temperature of 1500 F was selected. The major mechanical equipment considered includes the turbine motor/generator compressor train, intercooler and aftercooler system, and the exhaust gas regenerator. The cycle and machinery configuration and the specific mechanical equipment were selected for their Media site characteristics. These characteristics and the effect of component interdependency are considered when a conservative component design approach is established which satisfies the Media site CAES system requirements. DOE

N83-22770# Brookhaven National Lab, Upton, N. Y.
NICKEL-ZINC BATTERIES

J. MCBREEN, B. D. MCNICOL, ed., and D. A. J. RAND, ed. Jul 1982 35 p refs
 (Contract DE-AC02-76CH-00016)
 (DE83-000208, BNL-31729) Avail: NTIS HC A03/MF A01
 A review of the design, components, electrochemistry, operation and performance of nickel-zinc batteries is presented. DOE

N83-22785# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.

PARAMETRIC INVESTIGATIONS AND OTHER RELATED STUDIES OF ENERGY STORAGE TYPE CAPACITORS Quarterly Report

W. E. PACKER, B. ABDURASHID, R. C. DAHLGREN, J. R. REYNOLDS, and N. A. SIDNELL 1 Dec 1982 33 p
 (Contract DE-AC04-76DP-00656)
 (DE83-003426, GEPP-TIS-696) Avail: NTIS HC A03/MF A01

Studies on energy storage capacitors were made to evaluate the effect that processing temperatures have on voltage breakdown, evaluate three alternatives to the mica-filled epoxy encapsulant, improve winding techniques for multisection capacitors; evaluate the use of doubly metallized capacitor films, and develop standard practice guides for capacitor parameters. DOE

N83-22794# Alabama Univ., University. School of Mines and Energy Development.

AQUIFER THERMAL-ENERGY-STORAGE MODELING

W. J. SCHAEZLE and J. E. LECROY Sep 1982 99 p refs
 (DE83-900672, NP-3900672) Avail: NTIS HC A05/MF A01

A model aquifer was constructed to simulate the operation of a full size aquifer. Instrumentation to evaluate the water flow and thermal energy storage was installed in the system. Numerous runs injecting warm water into a preconditioned uniform aquifer were made. Energy recoveries were evaluated and agree with comparisons of other limited available data. The model aquifer is simulated in a swimming pool, 18 ft by 4 ft, which was filled with sand. Temperature probes were installed in the system. A 2 ft thick aquifer is confined by two layers of polyethylene. Both the aquifer and overburden are sand. Four well configurations are available. The system description and original tests, including energy recovery, are described. DOE

N83-22804# Pacific Northwest Lab, Richland, Wash.
ISSUES AFFECTING STORAGE OF COMPRESSED AIR IN SOLUTION-MINED SALT CAVITIES

R. D. ALLEN, T. J. DOHERTY, and R. L. THOMS (Louisiana State Univ.) Apr. 1982 10 p refs. Presented at the 17th Intersoc Energy Conversion Eng. Conf., Los Angeles, 8 Aug 1982
 (Contract DE-AC06-76RL-01830)
 (DE83-002017, PNL-SA-10076, CONF-820814-35) Avail: NTIS HC A02/MF A01

Geologic exploration and solution mining at Huntorf, Federal Republic of Germany, are discussed. Geologic factors affecting salt deposit acceptability for CAES include diameter, depth, thickness, mineralogy, strength, faulting, seismic susceptibility, caprock quality and dissolution rate by ground water. Assessment of a site involves analysis of existing information, seismic surveying, exploratory drilling, salt and caprock examination, geophysical

07 ENERGY STORAGE

logging, in situ stress measurement, and determination of hydrologic impact Cavern design parameters include octahedral shear strength, excess lateral stress, depth to cavern top, lateral salt thickness, vertical salt thickness, span, and height to diameter ratio. Noncompensated cavern operation involves cycling with respect to temperature, pressure, humidity and water Cavern, borehole and surface monitoring methods are discussed. DOE

N83-22805# Pacific Northwest Lab., Richland, Wash
AQUIFER COMPRESSED-AIR FIELD EXPERIMENT AT PITTSFIELD, ILLINOIS

R D ALLEN and T. J. DOHERTY Jun 1982 9 p refs
Presented at the AIAA/EPRI Intern. Conf. on UPH and Compressed Air Energy Storage, San Francisco, 21 Sep 1982
(Contract DE-AC06-76RL-01830)
(DE83-002057; PNL-SA-10166; CONF-820969-2) Avail: NTIS HC A02/MF A01

Compressed air energy storage (CAES) is an electrical generation load-leveling technique Air is stored within geologic reservoirs for use during peak demand Aquifers can store natural gas economically and may be suitable for CAES, but differences in geochemistry, cycling period, temperature and viscosity must be evaluated. Geologic exploration identified a test site near Pittsfield, Illinois The reservoir is a gently inclined dome consisting of impervious dolomitic caprock overlying permeable sandstone The closure is 200 m deep, about 200 m in radius, and 10 m thick Water discovery pressure is near 1100 kPa Air will be injected at near ambient temperature and relative humidity of about 5% Cyclic injections will take place at 500, 1000, 1500 and 2000 C, each set lasting three months. Temperature, pressure, liquid water content, relative humidity and withdrawn mineral particles will be monitored and analyzed to enable comparisons of reservoir behavior with numerical and experimental models Pre- and post-test cores will be compared with respect to chemical composition, mineralogy, microstructure, and physical properties. Data from the field and laboratory along with numerical modeling studies, will be integrated to develop comprehensive stability criteria for compressed air energy storage within aquifer type reservoirs DOE

N83-22806# Pacific Northwest Lab., Richland, Wash.

UNDERGROUND ENERGY-STORAGE PROGRAM OVERVIEW

L. D KANNBERG Jul. 1982 9 p Presented at the Energy Storage Contractors Rev. Meeting, Arlington, Va., 23 Aug. 1982
(Contract DE-AC06-76RL-01830)
(DE83-002059; PNL-SA-10591; CONF-820827-28) Avail: NTIS HC A02/MF A01

Characterization of the performance of thermal energy systems at injection temperatures of less than 850 C is nearly complete. Studies of injection and storage at temperatures up to 1500 C were initiated and continue through FY-1983 Studies of nonaquifer seasonal thermal energy systems including cavern and ice storage systems also continue Stability criteria and guidelines documents were published for salt and hard rock compressed air energy storage (CAES) reservoirs. A preliminary screening of materials for use in thermal storage units of adiabatic and hybrid CAES systems was completed Two materials, denstone and Dresser basalt, survived screening tests and are recommended for additional long term testing. DOE

N83-22815# Brookhaven National Lab., Upton, N Y Dept of Energy and Environment

INSTRUMENTATION OF THE BROOKHAVEN NATURAL THERMAL STORAGE HOUSE

H. T. GHAFFARI and R G. JONES 1982 10 p refs Presented at the Instrumentation Soc. of Am. Intern. Conf., Philadelphia, 18-21 Oct. 1982
(Contract DE-AC02-76CH-00016)
(DE83-000267; BNL-31828; CONF-821033-1) Avail: NTIS HC A02/MF A01

The Brookhaven Natural Thermal Storage House is a super-insulated energy-conserving house with various conservation and passive solar design features The house is fully instrumented;

72 data points are scanned every 6 seconds and recorded every 15 minutes The details on the datalogging system capable of receiving 48 analog, 16 digital, and 8 discrete inputs are discussed. The interfacing consists of an enclosure, terminal, modem, and magnetic tape recorder. Finally, the method of installation and schemes of measuring the ambient, surface, and mass temperatures, dew point, and weather data are explained DOE

N83-22834# Sandia Labs., Albuquerque, N. Mex.
STUDY OF BATTERY ACCELERATED-TESTING TECHNIQUES Final Report

J E CLIFFORD and R. E. THOMAS Apr 1982 85 p refs
(Contract DE-AC04-76DP-00789)
(DE82-017125; SAND-82-7049) Avail: NTIS HC A05/MF A01

A literature review and manufacturers survey was conducted to identify the status of accelerated testing and published information pertinent to battery life The principles of accelerated testing are reviewed with reference to lead-acid batteries Preliminary experimental designs for accelerated testing of batteries for solar applications are discussed with reference to current laboratory tests at Sandia covering minimal factorial design, the team approach to generally accepted accelerated test designs, and a suggested new approach to accelerated testing with minimal failures DOE

N83-22836# Massachusetts Univ., Amherst.
GEOTECHNICAL BASIS FOR UNDERGROUND ENERGY STORAGE IN HARD ROCK Final Report

O C FARQUHAR Mar 1982 409 p refs
(Contract EPRI PROJ 1199-11)
(DE82-903307; EPRI-EM-2260) Avail: NTIS HC A18/MF A01

Underground pumped hydroelectric storage requires the excavation of caverns in hard rock Hard rock caverns, also, are one option for compressed air storage Preliminary design studies for both technologies at a specific site were completed The geotechnical aspects of these storage systems are discussed from a generic viewpoint Information about effective use of hard rock openings, including tunnels and shafts, comes mainly from other types of underground projects These are power houses for hydroelectric and conventional pumped storage schemes, as well as transportation facilities and mines. Rock strength, support, instrumentation, costs, management, and experimental work are among the items considered. Mapping of geologic structures, rock fragmentation, and rock mass properties is also discussed The general conclusions are that rock types favorable for underground energy storage are present at suitable depths in many areas and that they can be identified by adequate geotechnical exploration prior to detailed design. DOE

N83-22837# MCC Associates, Inc., Silver Spring, Md
PROCEEDINGS OF THE MECHANICAL, MAGNETIC AND UNDERGROUND ENERGY-STORAGE 1981 ANNUAL CONTRACTORS' REVIEW

Feb 1982 393 p refs Meeting held in Washington, D.C., 24-26 Aug. 1981
(Contract W-7405-ENG-36)
(DE82-008853; CONF-810833) Avail: NTIS HC A17/MF A01

Various topics relating to energy storage are discussed. Compressed air storage, magnetic energy storage, thermal energy storage, and mechanical energy storage are discussed DOE

N83-23244# AiResearch Mfg. Co., Torrance, Calif.
STUDY OF VACUUM SYSTEMS FOR A HEAT ENGINE/FLYWHEEL AUTOMOTIVE PROPULSION SYSTEM Final Report

M D LIEBER 11 Jul. 1982 72 p refs Revised
(Contract W-7405-ENG-48)
(DE83-002284; UCRL-15502-REV-1) Avail: NTIS HC A04/MF A01

Vacuum systems for a heat engine/flywheel automotive propulsion system were investigated A vacuum environment is required to keep rotational losses and subsequent overheating of the flywheel energy storage unit (ESU) to a minimum The overall

vacuum system includes the vacuum pumps, flywheel shaft seals, vacuum sensors, tubing and any other components expressly designed with the purpose of maintaining the vacuum level in the ESU. The vacuum pump is the main component of the overall vacuum system and as such, most of this report details with selection of a vacuum pump. Information for selecting a vacuum system design with the ultimate goal of incorporating the flywheel into a mass produced automotive vehicle is presented DOE

08

GENERAL

A83-24975**INTERNATIONAL CONFERENCE ON FUTURE ENERGY CONCEPTS, 3RD, LONDON, ENGLAND, JANUARY 27-30, 1981, PROCEEDINGS**

Conference sponsored by the Institution of Electrical Engineers London, Institution of Electrical Engineers (IEE Conference Publication, No 192), 1981 372 p

Electric cars are considered along with questions regarding solar energy as alternative or complementary energy concept, aspects of high temperature heat storage, wind turbine response and system integration, the development of the coal fired combined cycle and gas turbine cycle for power generation, the performance characteristics of a variable speed heat pump, and the economics of satellite solar power system operation. Attention is also given to the generation and transmission of electricity from wave energy schemes, the effect of building construction on the value of solar radiation to reduce heat needs, the performance optimization of photovoltaic converters using a microprocessor, power transmission from offshore wind generation systems, and the properties of the polyol fuel cell. Other subjects explored are related to the performance of a Wells turbine for use in a wave energy system, the combustion of low-grade fuels in a fluidized bed, coal gasification for combined cycle power generation, the cost of power recovery from waste heat, and energy from biomass. G.R.

A83-25450**ADDITIONAL SOLAR SPECTRAL DATA SETS**

R. E. BIRD and R. L. HULSTROM (Solar Energy Research Institute, Golden, CO) Solar Cells, vol 8, Feb 1983, p. 85-95. refs

Eight solar spectra are presented in tabulated and graphical form. Four of these spectra are direct normal radiation and the other four are for global normal radiation. Each type of radiation is presented for air mass values of 1.0 and 2.0 and for atmospheric turbidities of 0.1 and 0.27 at 0.5 micron wavelength. These data were generated using the BRITE Monte Carlo radiative transfer code, the revised Neckel and Labs extraterrestrial spectrum, the U.S. standard atmosphere model and the rural aerosol model.

(Author)

N83-16891# Department of Energy, Oak Ridge, Tenn. Technical Information Center.

ENERGYGRAMS: BRIEF DESCRIPTIONS OF ENERGY TECHNOLOGY

W. F. SIMPSON, JR., ed. 1982 91 p
(DE82-003278, DOE/TIC/EGC-82/1, PB82-903601, ISSN-0731-6291) Avail: NTIS HC A05/MF A01

The Energygram program transfers information and technology generated from research to identifiable audiences in industry, education, and federal, state, and local government. Research and development projects for the transfer program are identified and the technical content of Energygrams before publication are reviewed. Energygrams are usually one page illustrated bulletins describing DOE technology or data and telling how to obtain the technical reports or other material on which they are based. The compilation is organized by subject categories, and, within each category, Energygrams are presented alphabetically by Energygram title. DOE

N83-16892# Department of Energy, Oak Ridge, Tenn. Technical Information Center.

ENERGYGRAMS: BRIEF DESCRIPTIONS OF ENERGY TECHNOLOGY

W. F. SIMPSON, JR., ed. Dec. 1981 87 p
(DE82-003277, DOE/TIC/EGC-81) Avail: NTIS HC A05/MF A01

Energygrams are a compilation of technical notes for the purpose of transferring information and technology generated from research to identifiable audiences in industry, education, and federal, state, and local government. All DOE R and D reports are screened for identification of appropriate information. It coordinates laboratory and contractor program managers by identifying research and development projects for the transfer program and in reviewing the technical content of Energygrams before publication. Energygrams are usually one page illustrated bulletins describing DOE technology or data and telling how to obtain the technical reports or other material on which they are based. The compilation is organized by subject categories, and, within each category, Energygrams are presented alphabetically by Energygram title. DOE

N83-17686# Bosch (Robert) G.m.b.H., Gerlingen (West Germany). Technisches Zentrum Forschung.

DEVELOPMENTS AND APPLICATIONS OF TANTALUM THIN FILMS AND HYBRID TECHNOLOGY Final Report, Sep. 1977

G. KRUEGER Bonn Bundesministerium fuer Forschung und Technologie Oct 1982 349 p refs In GERMAN; ENGLISH summary. Sponsored by Bundesministerium fuer Forschung und Technologie (BMFT-FB-T-82-173; ISSN-0340-7608) Avail: NTIS HC A15/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 51,50

The effects of technology development in the fields of thin films, etching and trimming techniques, and the processes for assembling of hybrid blocks are discussed. The processes have been cheapened by using less expensive materials, and at the same time safety and economy of fabrication have been secured. The reliability and flexibility attained are sufficient for technological and electronic requirements. E.A.K.

N83-17760# Joint Publications Research Service, Arlington, Va. FIAT RESEARCHERS STUDY CERAMICS APPLICATIONS IN DIESELS

A. GIACHELLO, S. GUERRA, and P. C. MARTINENGO In *its* West Europe Rept.: Sci. and Technol., No 133 (JPRS-82608) p 23-30 10 Jan. 1983 refs Transl into ENGLISH from ATA-Ing Automotoristica (Italy), Sep. 1982 p 675-679 Avail: NTIS HC A03/MF A01

It is known that the use of engineered ceramic materials can considerably improve the efficiency of internal-combustion engines by minimizing the heat losses and recovering mechanical energy from the exhaust gases. In particular, such materials' resistance to high temperatures, low coefficient of expansion and very low heat conductivity constitute the basis for development of partially or totally ceramicized engines running in high heat cycles.

Author

N83-17761# Joint Publications Research Service, Arlington, Va. WEST EUROPE REPORT: SCIENCE AND TECHNOLOGY, NO. 134

20 Jan 1983 80 p Transl into ENGLISH from various West European articles (JPRS-82686) Avail: NTIS HC A05/MF A01

Studies and progress in Western European science and technology are reported. Topics discussed include biotechnology, genetic engineering; chemicals; electronics; energy; industrial technology, laser machine tools; transportation.

08 GENERAL

N83-19315# Nelson and Johnson Engineering, Inc., Boulder, Colo.

MINE PERSONNEL LOCATOR AND MINE ACTIVITY CONTROLLER Open File Report, 17 Sep. 1980 - 8 Sep. 1981

A. J. FARSTAD, L. R. ROBINSON, and G. H. SAUM Dec. 1981 188 p refs

(Contract DI-BM-J0-205059)

(PB82-235979; BM-OFR-80-82) Avail NTIS HC A09/MF A01

CSSL 081

A computerized system was designed that is capable of not only tracking the location of the miner but also of monitoring underground parameters, communicating between work stations, and sounding alarms when underground conditions are judged to be unsafe. The locations of underground personnel are detected by a network of underground terminals that routinely emit radiofrequency (RF) pulses to interrogate miniature transponders worn by the miners. Each transponder is uniquely programmed to delay its response so that the RF terminal can identify the individual transponders by the time slots in which the responding pulses are received. The underground terminals are then interrogated by the host computer on the surface that keeps a running account on underground mine conditions and personnel. The underground portion of the system is designed to operate even during mine emergencies, deriving its power from rechargeable battery supplies that are float charged during normal operation. GRA

N83-19316# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

HEAVY GAS DISPERSAL

1982 303 p refs Lecture held in Rhode-Saint-Genese, Belgium, 8-12 Mar 1982

(VKI-LS-1982-03) Avail: NTIS HC A14/MF A01

The state-of-the-art in the field of fluid dynamics concerned with the prediction of the hazardous area after catastrophic failure of a gas tank or a vessel, or an accidental release of heavy gas, is considered

N83-19317# Imperial Chemical Industries Ltd., Runcorn (England)

INTRODUCTORY LECTURE: STATEMENT OF THE PROBLEM

N. C. HARRIS /in Von Karman Inst for Fluid Dyn. Heavy Gas Dispersal 12 p 1982 refs

Avail: NTIS HC A14/MF A01

Aspects of the dispersion of heavy gases which warrant closer attention are considered. Author

N83-19318# Battelle Inst., Frankfurt am Main (West Germany)
IDENTIFICATION OF PROBLEM AREAS RELATED TO THE DISPERSION OF HEAVY GASES

S. HARTWIG /in Von Karman Inst for Fluid Dyn. Heavy Gas Dispersal 34 p 1982 refs

Avail: NTIS HC A14/MF A01

Heavy gases, cold gases, and aerosols are considered. Gravity spreading and entrainment are discussed. Author

N83-19702# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

ACTIVITIES REPORT IN SPACE RESEARCH IN THE FEDERAL REPUBLIC OF GERMANY Annual Report, 1981 [JAHRESBERICHT 1981]

Sep. 1982 161 p refs In GERMAN

Avail: NTIS HC A08/MF A01

Activities and progress in West German aerospace research are reported. The following topics are presented: results on traffic and communication systems, aviation, space technology, energy and propulsion technology; organization and structure; management, different branches of the aerospace industry, flight mechanics, flow mechanics, materials and construction, information dissemination and retrieval, wind tunnels. E.A.K

N83-20821# Department of Energy, Oak Ridge, Tenn. Technical Information Center

ENERGY DATA BASE GUIDE TO ABSTRACTING AND INDEXING

L. T. WHITEHEAD, ed. Dec. 1981 146 p

(DE82-005748; DOE/TIC-4583/R3) Avail: NTIS HC A07/MF A01

The principles employed in abstracting and subject indexing information for its data bases and abstract journals are described. Information on the mission and responsibilities of TIC, the data bases and abstract journals maintained and produced, the associated acquisition, subject categorization, retrieval functions, and other information processing activities is included. DOE

N83-22480# National Technical Information Service, Springfield, Va.

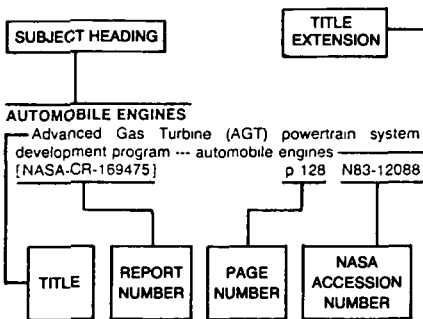
FEDERAL TECHNOLOGY CATALOG 1982: SUMMARIES OF PRACTICAL TECHNOLOGY Tech Notes Annual Index

1982 331 p

(PB83-121533) Avail: NTIS HC \$19.50

The catalog presents summaries of practical technology selected for commercial potential and/or promising applications to the fields of computer technology, electrotechnology, energy, engineering, life sciences, machinery and tools, manufacturing, materials, physical sciences, and testing and instrumentation. Each summary not only describes a technology, but gives a source for further information. This publication describes some 1,100 new processes, inventions, equipment, software, and techniques developed by and for dozens of Federal agencies during 1982. Included is coverage of NASA Tech Briefs, DOE Energygrams, and Army Manufacturing Notes. M.G.

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title, and title extension if used, provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The page and accession numbers are located beneath and to the right of the title. Under any subject heading the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

A

ABSORBERS (EQUIPMENT)

- Research on application of Arc-Plasma Spraying (APS) [DE82-015220] p 70 N83-20408
- Adiabatic absorption and desorption for improvement of temperature-boosting adsorption heat pumps [DE83-002589] p 33 N83-21611

ABSORPTION SPECTRA

- Terrestrial solar spectral data sets [DE83-000504] p 60 N83-17001

ABSORPTIVITY

- Solar-absorber-selective paint research [DE82-006104] p 61 N83-18050
- Solar-collector materials exposure to the IPH site environment. Task 50 [DE83-002192] p 62 N83-18072
- Wave model. A numerical model for the fractional absorption of water waves [PB83-100792] p 122 N83-20073
- Outdoor exposure tests of solar absorptive coatings [PB83-124560] p 84 N83-22840

ABSTRACTS

- Miami International Conference on Alternative Energy Sources, 5th, Miami Beach, FL, December 13-15, 1982, Proceedings of Condensed Papers p 3 A83-25575
- Energygrams. Brief descriptions of energy technology [DE82-003278] p 199 N83-16891
- Energygrams. Brief descriptions of energy technology [DE82-003277] p 199 N83-16892
- Energy data base guide to abstracting and indexing [DE82-005748] p 200 N83-20821
- International Energy Workshop, 1981 [DE82-021183] p 36 N83-22816

ACCELERATED LIFE TESTS

- Accelerated aging of GaAs concentrator solar cells [DE82-016658] p 69 N83-20390
- Study of battery accelerated-testing techniques [DE82-017125] p 198 N83-22634

ACCIDENTS

- Manufacture, distribution, and handling of nitrate salts for solar-thermal applications [DE83-003317] p 79 N83-21625

ACCUMULATORS

- Bipolar lead accumulator cell with high energy density [PB82-258757] p 193 N83-16934
- Low-cost, high-performance solar flat-plate collectors for applications in northern latitudes [DE82-010626] p 71 N83-20428

ACCURACY

- Preliminary analysis of the state of the art of robotics and precision engineering and evaluation of potential for improved energy utilization in the pulp, paper, and related energy-consuming processes [DE83-001016] p 21 N83-19294

ACETYLENE

- Semiconducting polyacetylene materials for energy-conversion applications [DE82-012320] p 70 N83-20407

ACID RAIN

- Acid rain mitigation study. Volume 1. FGD cost estimates [PB83-101329] p 29 N83-20459
- Acid rain mitigation study. Volume 2. FGD cost estimates, appendices [PB83-117366] p 29 N83-20469
- Acid precipitation. A critique of present knowledge and proposed action [DE83-900303] p 34 N83-21650
- Acid precipitation and the use of fossil fuels [GPO-98-172] p 36 N83-22846

ACIDS

- Evaluation of tetrafluoroethane-1,2-disulfonic acid as a fuel cell electrolyte p 161 A83-28300

ACOUSTIC MICROSCOPES

- Evaluation of various solar-cell-to-interconnector welds by means of scanning laser acoustic microscopy and metallography [ESA-STM-225] p 73 N83-21514

ACOUSTIC SOUNDING

- Development of a quiet Stirling cycle multi-fuel engine for electric power generation [AD-A121033] p 174 N83-19278

ACRYLIC RESINS

- Design and development of monolithic acrylic Fresnel lenses for use in point-focus PV systems [DE82-007554] p 72 N83-20768

ACTIVATED CARBON

- Cleanup of groundwater contaminated by underground coal gasification [DE82-005824] p 19 N83-18118

ACTIVITY (BIOLOGY)

- Fractionation of an oil shale retort process water. Isolation of photoactive genotoxic components [DE82-010428] p 108 N83-18014

ADAPTIVE CONTROL

- Application of multivariable systems theory, Symposium, Plymouth, England, October 26-28, 1982, Collected Papers p 151 A83-23171

ADDITIVES

- Effect of manganese additions on the performance of aluminum air-battery anode alloys [DE83-002277] p 196 N83-21629
- Effects of several disposable catalysts on liquefaction of lignite [DE82-022188] p 138 N83-22351

ADHESIVES

- Effects of gaps in adhesives that bond elastically deformed panels to parabolic, cylindrical substructures [DE82-014720] p 72 N83-21154

ADIABATIC CONDITIONS

- Adiabatic absorption and desorption for improvement of temperature-boosting adsorption heat pumps [DE83-002589] p 33 N83-21611
- Reverse-combustion, horizontal retorting of oil shale [DE83-000018] p 137 N83-22350

ADSORPTION

- Identification and mutagenicity of nitrogen-containing polycyclic aromatic compounds in synthetic fuels [DE82-006173] p 106 N83-17739

- Fundamental research on Fischer-Tropsch synthesis [BMFT-FB-T-82-020] p 125 N83-21052

AERIAL PHOTOGRAPHY

- Use of remote sensing techniques to study geothermal resources in arid and semi-arid zones in Chile p 92 A83-24577
- Structural geomorphology of Rajasthan basin, India-interpreted through Landsat imagery and aerial photos p 92 A83-24626

AERODYNAMIC CHARACTERISTICS

- Aerodynamic tests of Darrieus wind turbine blades p 151 A83-23128
- On aerodynamic design of the Savonius windmill rotor p 160 A83-27325
- Energy efficient engine. Fan test hardware detailed design report [NASA-CR-165148] p 4 N83-16341
- Fuel conservation techniques in jet transport aircraft operations p 12 N83-17483
- Slidestop indication system p 12 N83-17466
- Fixed pitch rotor performance of large horizontal axis wind turbines p 169 N83-19233
- Stall induced instability of a teetered rotor p 169 N83-19234
- Free yaw performance of the Mod-0 large horizontal axis 100 kW wind turbine p 170 N83-19235

AERODYNAMIC STABILITY

- Aeroelastic stability and dynamic response analysis of the LDB-125 vertical axis wind turbine [FFA-TN-1982-19] p 167 N83-18028
- Some experiments on Yaw stability of wind turbines with various coning angles [NASA-CR-168108] p 181 N83-22740

AERODYNAMICS

- The investigation of passive blade cyclic pitch variation using an automatic yaw control system [DE83-000651] p 178 N83-21548

AEROELASTICITY

- Aeroelastic stability and dynamic response analysis of the LDB-125 vertical axis wind turbine [FFA-TN-1982-19] p 167 N83-18028
- Simplified aeroelastic modeling of horizontal axis wind turbines [NASA-CR-168109] p 178 N83-21509

AERONAUTICS

- Activities report in space research in the Federal Republic of Germany p 200 N83-19702

AEROSOLS

- Heavy Gas Dispersal [VKI-LS-1982-03] p 200 N83-19316
- Identification of problem areas related to the dispersion of heavy gases p 200 N83-19318

AEROSPACE ENVIRONMENTS

- Space applications of gallium arsenide solar cells p 50 A83-27258

AEROSPACE INDUSTRY

- Activities report in space research in the Federal Republic of Germany p 200 N83-19702

AEROSPACE SYSTEMS

- The NASA program in Space Energy Conversion Research and Technology p 160 A83-27326
- Research needs. Prime-power for high energy space systems [AD-A120209] p 163 N83-16861

AEROSPACE TECHNOLOGY TRANSFER

- Research needs. Prime-power for high energy space systems [AD-A120209] p 163 N83-16861

AEROTHERMODYNAMICS

- Advanced Gas Turbine (AGT) powertrain system development for automotive applications [NASA-CR-167983] p 166 N83-17424

AGGLOMERATION

- Development of standards and a cost model for coal agglomeration and related studies [DE82-011047] p 105 N83-17678
- Development and demonstration of process and components for the control of aluminum-air-battery electrolyte composition through the precipitation of aluminum trihydroxide [DE83-002490] p 180 N83-21623

AGING (MATERIALS)

- Nonstandard aging tests on coal-derived distillate fuels
[DE82-010442] p 97 N83-16562
Development of copper sulfide/cadmium sulfide thin-film solar cells
[DE83-001421] p 74 N83-21539

AGRICULTURE

- Photovoltaic off-farm agricultural applications Volume 1 Executive summary
[DE82-008487] p 70 N83-20398
Progress of solar technology and potential farm uses
[PB83-100065] p 71 N83-20436
Energy inputs and outputs of fuel-alcohol production, appendices C through F Methanol from cellulose
[DE83-000369] p 130 N83-21178
Assessment of methane-related fuels for automotive fleet vehicles Volume 1 Executive summary
[DE83-000280] p 130 N83-21185
Energy from biomass Land analysis and evaluation of supply models
[DE83-003333] p 132 N83-21524
Photovoltaic off-farm agricultural applications Volume 2 Technical report
[DE82-009320] p 76 N83-21562

AIR

- Enriched-air and oxygen gasification of Illinois No. 6 coal in a Texaco coal-gasification unit
[DE82-903133] p 139 N83-22362

AIR CONDITIONING

- Analysis of energy use at US institutional buildings
[DE82-004670] p 6 N83-16886
Strategies for energy conservation in small office buildings
[PB82-245820] p 22 N83-19306

AIR COOLING

- Low power, air-cooled DC-Link aircraft generation systems
p 159 A83-27324
Advanced solar/gas desiccant cooling system
[PB82-243833] p 62 N83-18968

AIR FLOW

- General review of wind engineering problems
p 114 N83-18944
Multiple-tracer gas analyzer
[DE82-017032] p 120 N83-19876
Program listing for air-to-air heat pump steady-state Computer-Simulation Mode (CSM)
[DE83-002549] p 32 N83-21559

AIR JETS

- Flames with impinging jets
p 91 A83-21423

AIR POLLUTION

- The influence of large-scale advection on the vertical distribution of stratospheric source gases in 44 degree and 41 degree north
p 1 A83-20224
The origin and nature of 'prompt' nitric oxide in flames
p 1 A83-22344
The seasonal variation of the atmospheric SO₂ to SO₄⁻ conversion rate
p 2 A83-24279
Design strategy for the combustion of coal-derived liquid fuels
[DE82-905496] p 95 N83-16444
Investigation of methanol as a boiler fuel for electric-power generation
[DE82-905495] p 97 N83-16560
The implications of a stochastic approach to air-quality regulations
[DE83-001636] p 9 N83-16972
Simulation of air-pollution propagation resulting from at-sea incineration wastes
[DE82-902297] p 10 N83-16979
A rationale for advances in the technology of I C engines
[DE82-005840] p 14 N83-17889
Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States
[DE82-011237] p 18 N83-18108
Estimating pollutant exposures from coal fired power plants in a rural region
[DE82-008136] p 19 N83-18109
Basic combustion and pollutant-formation processes for pulverized fuels
[DE82-013773] p 29 N83-20457
Acid precipitation: A critique of present knowledge and proposed action
[DE83-900303] p 34 N83-21650
Biostatistics and health impacts of energy technologies
p 36 N83-22962

AIR QUALITY

- The implications of a stochastic approach to air-quality regulations
[DE83-001636] p 9 N83-16972
A preliminary study of environmental parameters associated with the feasibility of a polygeneration plant at Kennedy Space Center
p 11 N83-17365

- Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States
[DE82-011237] p 18 N83-18108
Evaluation of the maintenance effect on fugitive emissions from refineries in the south coast air quality management district
[PB82-239260] p 23 N83-19356
Preliminary evaluation of environmental issues on the use of peat as an energy source
[DE83-000820] p 34 N83-21651
Future landscapes of the Colorado plateau Impacts of energy development
[DE83-900473] p 34 N83-21666

AIR TRAFFIC

- Activities report in space research in the Federal Republic of Germany
p 200 N83-19702

AIR TRAFFIC CONTROL

- Energy conservation in air transportation - The Canadian Air Traffic Control Effort
p 4 A83-29393
Air traffic control Its effect on fuel conservation
p 12 N83-17464
Fuel conservation and economy constraints
p 34 N83-22179

AIR TRANSPORTATION

- Energy conservation in air transportation - The Canadian Air Traffic Control Effort
p 4 A83-29393
West Europe report Science and technology, no 134 [JPRS-82686] p 199 N83-17761

AIRCRAFT CONFIGURATIONS

- General aviation airplane fuel economy system model
p 20 N83-18647

AIRCRAFT DESIGN

- Turbine engine fuel conservation by fan and compressor profile control
p 12 N83-17467

AIRCRAFT ENGINES

- PW 4000 - A radically new jet engine being developed in the USA
p 1 A83-23239
A system of criteria for evaluating the energy efficiency of an engine at the state of technical proposals
p 1 A83-23437
Rotary engines
p 152 A83-25140
Energy efficient engine Fan test hardware detailed design report
[NASA-CR-165148] p 4 N83-16341
A method to estimate weight and dimensions of small aircraft propulsion gas turbine engines User's guide
[NASA-CR-168049] p 162 N83-16343
Lightweight aircraft engines, the potential and problems for use of automotive fuels
p 141 N83-22446
The spark-ignition aircraft piston engine of the future
p 141 N83-22450

AIRCRAFT EQUIPMENT

- Low power, air-cooled DC-Link aircraft generation systems
p 159 A83-27324

AIRCRAFT FUELS

- Fuel for future transport aircraft
p 85 A83-20082
Radiation and smoke from the gas turbine combustor using heavy fuels
p 92 A83-23877
Degradation and characterization of antimisting kerosene
p 92 A83-24035
Ground contamination by fuel jettisoned from aircraft in flight
p 1 A83-24041
Is LH₂ the high cost option for aircraft fuel
p 87 A83-27215
Symposium on Commercial Aviation Energy Conservation Strategies Papers and presentations
[AD-A107106] p 11 N83-17455
Aircraft towing feasibility study
p 11 N83-17458
An overview of the DOT/FAA aviation energy conservation policy
p 11 N83-17460
Experimental study of the thermal stability of hydrocarbon fuels
[NASA-CR-168027] p 105 N83-17728
Aviation Gasolines and Future Alternatives
[NASA-CP-2267] p 140 N83-22442
Industry's assessment of the number of airplanes in the general aviation fleet along with their hours flown and fuel consumption data powered by what type of engines, when and for what reasons, through the year 2000
p 140 N83-22445
Lightweight aircraft engines, the potential and problems for use of automotive fuels
p 141 N83-22446
Manufacturing comparisons of aviation and motor gasolines
p 141 N83-22448
Fuel supply and distribution Fixed base operation
p 141 N83-22449
Future of alternate fuels for turbine engines
p 141 N83-22453

AIRCRAFT GUIDANCE

- An on-board near-optimal climb-dash energy management
[NASA-CR-169755] p 4 N83-16329

AIRCRAFT NOISE

- The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations --- (Los Angeles)
p 11 N83-17459

AIRCRAFT SAFETY

- Fuel conservation and economy constraints
p 34 N83-22179

AIRFOIL PROFILES

- Turbine engine fuel conservation by fan and compressor profile control
p 12 N83-17467

AIRFOILS

- Low-cost composite blades for the Mod-0A wind turbines
p 170 N83-19242
Fiberglass composite blades for the 4 MW - WTS-4 wind turbine
p 170 N83-19243
Design and evaluation of low cost blades for large wind driven generating systems
p 170 N83-19244
Structural fatigue test results for large wind turbine blade sections
p 170 N83-19246

AIRFRAMES

- Potential fuel savings through improved airframe maintenance
p 11 N83-17456

AIRLINE OPERATIONS

- The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations --- (Los Angeles)
p 11 N83-17459

AIRPORT PLANNING

- The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations --- (Los Angeles)
p 11 N83-17459

AIRPORTS

- Airport solar photovoltaic concentrator
[DE83-003137] p 68 N83-20384
Intermediate photovoltaic system application experiment operational performance report Volume 1 Dallas - Fort Worth Regional Airport, Texas, July 1982
[DE83-004763] p 84 N83-22819

ALASKA

- Uranium hydrogeochemical and stream sediment reconnaissance of the St Michael NTMS quadrangle, Alaska
[DE82-009999] p 99 N83-16844
Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska
[DE82-009666] p 115 N83-19196
Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197
Geothermal energy resource assessment of parts of Alaska
[DE83-000140] p 116 N83-19299
Alaskan coal Resources and developmental constraints
[DE83-000860] p 130 N83-21494
Hydrogen use in a rural Alaskan community
[DE83-000568] p 90 N83-22813

ALCOHOLS

- Energy-efficient alcohol-fuel production
[DE82-011278] p 122 N83-19944
Effect of low-proof alcohol fumigation-fueling on crankcase oil dilution in a diesel-cycle engine
[DE83-002976] p 122 N83-20171
Devising efficient biotechnological processes for the production of fuels and chemicals from biomass
[DE82-017089] p 124 N83-20418
Propanol-plus as extender to diesel fuel
[CSIR-ME-445] p 128 N83-21165
Technical/commercial feasibility study of the production of fuel-grade ethanol for corn 100-million gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000772] p 129 N83-21173
Energy inputs and outputs of fuel-alcohol production, appendices C through F Methanol from cellulose
[DE83-000369] p 130 N83-21178
Methanol production from fermentor off-gases
[DE83-005011] p 145 N83-22793

ALGAE

- Photobiology task of the advanced solar energy research program
[DE82-012310] p 71 N83-20417

ALGORITHMS

- ASPEN technical reference manual
[DE82-020201] p 112 N83-18325
Open-cycle systems performance analysis programming guide
[DE82-005696] p 174 N83-19282

ALKALI METALS

- Alkali-metal-vapor removal from pressurized fluidized-bed combustor flue gas
[DE82-008088] p 10 N83-16976
Catalytic effects of alkali metal salts in the gasification of coal char
[DE82-000850] p 103 N83-17645
Heat pipes containing alkali metal working fluid
[NASA-CASE-LEW-12253-1] p 186 N83-19596

ALKALIES

- Hot-gas cleanup for molten-carbonate fuel cells
[DE82-002500] p 163 N83-16864

ALKALINE BATTERIES

- Cross-linked polyvinyl alcohol films as alkaline battery separators p 149 A83-20576
 Large nickel alkaline batteries p 189 A83-27176
 Development of gas-phase metallized plaques for electrodes of storage batteries, in particular for nickel oxide electrodes [PB82-255431] p 193 N83-16950

ALKANES

- Organic Rankine cycle coupled to a solar pond by direct-contact heat exchange - selection of a working fluid [DE82-020998] p 57 N83-16900

ALKENES

- High performance liquid chromatographic hydrocarbon group-type analyses of mid-distillates employing fuel-derived fractions as standards [NASA-TM-83072] p 120 N83-19920

ALLOYS

- Effect of simulated medium-Btu coal gasifier atmospheres on the biaxial stress rupture behavior of four candidate coal gasifier alloys [DE82-008607] p 104 N83-17661
 Physical properties data compilations relevant to energy storage Part 5 Mechanical properties data on alloys for use in flywheels [PB82-232919] p 194 N83-18904

ALTITUDE

- Solar altitude frequency tables p 39 A83-22617

ALUMINATES

- An evaluation of hydrated calcium aluminate compounds as energy storage media [PB82-249921] p 194 N83-19308
 Development and demonstration of process and components for the control of aluminum-air-battery electrolyte composition through the precipitation of aluminum trihydroxide [DE83-002490] p 180 N83-21623

ALUMINUM

- Study on composite flywheels for energy storage p 188 A83-22701
 Performance testing of the Acurex solar collector model 3001-03 [DE82-013389] p 77 N83-21603

ALUMINUM ALLOYS

- Effect of manganese additions on the performance of aluminum air-battery anode alloys [DE83-002277] p 196 N83-21629

ALUMINUM GALLIUM ARSENIDES

- Accelerated aging of GaAs concentrator solar cells [DE82-016658] p 69 N83-20390

AMBIENT TEMPERATURE

- Rymark 1, Rymark 2, and Rymark 3, Frederick, Maryland Solar-energy-system performance evaluation, May 1981 through March 1982 [DE83-000067] p 57 N83-16890
 Gill Harrop, Big Flats, New York solar-energy-system performance evaluation [DE83-000065] p 57 N83-16895
 Intermediate photovoltaic system application experiment operational performance report for Lovington Square Shopping Center, Lovington, New Mexico [DE83-000391] p 57 N83-16896

AMBIPOLAR DIFFUSION

- Open-circuit voltages across two junctions in n/-p-p/- solar cells under high illumination levels p 51 A83-27976

AMERICAN INDIANS

- Energy development on Native American lands Resources and attitudes An interpretive report on two major Indian conferences of 1980 [DE82-009539] p 17 N83-18076

AMINES

- Evaluation of gasification and gas cleanup processes for use in molten carbonate fuel cell power plants [DE83-003821] p 183 N83-22787

AMMONIA

- Study based on ammonia/water solutions of a district heating transport system [BMFT-FB-T-82-188] p 186 N83-18033
 Dynamic simulation of sulfur-removal systems [DE82-902074] p 119 N83-19865
 Evaluation of ammonia as a working fluid for a wet/dry-cooled binary geothermal plant [DE83-002895] p 135 N83-21631

AMORPHOUS MATERIALS

- Computer simulation of the optical behaviour of amorphous silicon solar cells p 51 A83-27979

AMORPHOUS SEMICONDUCTORS

- Origin of the difference in the open circuit voltage between p-n type and n-p type hydrogenated amorphous silicon solar cells p 37 A83-19991
 Amorphous silicon - A new semiconductor material for solar cells p 39 A83-21627
 Effect of an SiC layer on p-n amorphous silicon solar cells p 40 A83-22909

Amorphous silicon bibliography update - Introduction

- p 41 A83-22915
 Amorphous silicon photovoltaic modules p 45 A83-26064
 Photovoltaic advanced research and development program in the United States [DE83-000307] p 83 N83-22814

AMPLITUDES

- Wave model A numerical model for the fractional absorption of water waves [PB83-100792] p 122 N83-20073

ANAEROBES

- Municipal-solid-waste biconversion technologies [DE83-000263] p 100 N83-16893
 Landfill gas to electricity demonstration project [PB82-255290] p 7 N83-16943
 methods for evaluating the DOE
 Appropriate-Technology Program A review and compilation of evaluation methods [DE83-003306] p 145 N83-22781

ANEMOMETERS

- Design and standardization of meteorological measurements for wind energy converting systems [BMFT-FB-T-82-168] p 168 N83-18172
 Potential errors in using one anemometer to characterize the wind power over an entire rotor disk p 171 N83-19254

ANGLES (GEOMETRY)

- The design, effectiveness and construction of passive-thermal-control roofing shingles [DE83-001465] p 75 N83-21557
 Some experiments on yaw stability of wind turbines with various coning angles [NASA-CR-168108] p 181 N83-22740

ANGULAR VELOCITY

- The investigation of passive blade cyclic pitch variation using an automatic yaw control system [DE83-000651] p 178 N83-21548

ANNEALING

- Parametric investigations and other related studies of energy storage type capacitors [DE83-003426] p 197 N83-22785

ANNUAL VARIATIONS

- Distribution of and changes in industrial carbon dioxide production p 2 A83-24256
 The seasonal variation of the atmospheric SO₂ to SO₄ conversion rate p 2 A83-24279
 User's manual for heat-pump Seasonal-Performance Model (SPM) with selected parametric examples [DE83-002455] p 31 N83-21552
 DOE small-scale hydroelectric demonstration program F W E Staphorst, Inc., Goodyear Lake hydroelectric-generating-station redevelopment [DE83-003156] p 182 N83-22780
 Investigation of attic insulation effectiveness using actual energy consumption data [DE83-000225] p 36 N83-22828

ANODES

- Electrophoretically deposited CdS and CdSe anodes for photoelectrochemical cells p 149 A83-19883

ANOMALIES

- Subsea permafrost in Harrison Bay, Alaska An interpretation from seismic data [AD-A121020] p 125 N83-20479

ANTENNA COMPONENTS

- On the choice of the optimal density of vibrators for a rectenna p 184 A83-23464

ANTENNA DESIGN

- On the choice of the optimal density of vibrators for a rectenna p 184 A83-23464

ANTENNA RADIATION PATTERNS

- On the choice of the optimal density of vibrators for a rectenna p 184 A83-23464

ANTIMISTING FUELS

- Degradation and characterization of antimisting kerosene p 92 A83-24035
 Anti-misting additives for jet fuels [NASA-CR-169751] p 94 N83-16417
 Viscometric and misting properties of polymer-modified fuel [NASA-CR-169750] p 96 N83-16543
 Degradation and characterization of antimisting kerosene (AMK) [MED-132] p 120 N83-19922

ANTIREFLECTION COATINGS

- Design of antireflection coatings for textured silicon solar cells p 52 A83-27983
 Reactive sputtered Ta₂O₅ antireflection coatings p 52 A83-27984
 Optical properties of sputtered Si H [DE82-007072] p 62 N83-18491
 Graded-index antireflective coatings for glass [DE82-016756] p 67 N83-19917

APERTURES

- Optimization of dish solar collectors with and without secondary concentrators [NASA-CR-169928] p 64 N83-19224

APPALACHIAN MOUNTAINS (NORTH AMERICA)

- ERRSAC contributions to the search for Appalachian hydrocarbons p 114 N83-19155

AQUATIC PLANTS

- The utilization of emergent aquatic plants for biomass-energy-systems development [DE82-009174] p 124 N83-20395

AQUEOUS SOLUTIONS

- Performance and operational analysis of a liquid desiccant open-flow solar collector p 49 A83-27246
 Formation/decomposition of condensable hydrocarbons during the gasification of coal [DE82-014493] p 119 N83-19866
 Study of the electrowinning of copper using a fluidized-bed electrochemical reactor [DE83-004854] p 181 N83-22404

AQUIFERS

- Increasing summer peak power with aquifer storage p 191 A83-27313

- AQUASTOR - A computer model for cost analysis of aquifer thermal energy storage coupled with distinct heating or cooling systems p 191 A83-27314

- Guidelines for sampling and analyzing solutions for aquifer thermal-energy-storage systems [DE83-001852] p 10 N83-16973

- Western oil-shale development, a technology assessment Volume 6 Oil-shale development in the Piceance Creek Basin and potential water-quality changes [DE82-005659] p 108 N83-18009

- Investigation of the geothermal potential of the UK The Southampton (Western Esplanade) geothermal well A preliminary assessment of the resource p 109 N83-18029

- Cost of heat from a seasonal source [DE82-006026] p 194 N83-18045

- Compressed-air energy storage Preliminary design and site-development program in an aquifer Volume 3 Site-selection study, part 2 [DE83-001252] p 194 N83-18074

- Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model [DE83-004004] p 197 N83-22758

- Aquifer thermal-energy-storage modeling [DE83-900672] p 197 N83-22794

- Aquifer compressed-air field experiment at Pittsfield, Illinois [DE83-002057] p 198 N83-22805

ARC SPRAYING

- Research on application of Arc-Plasma Spraying (APS) [DE82-015220] p 70 N83-20408

ARCHITECTURE

- Design and construction of a demonstration residence utilizing natural thermal storage [DE82-005508] p 5 N83-16569

- New design concepts for energy-conserving buildings Results of a national competition among students in schools of architecture [DE82-013319] p 24 N83-19950

- Initial detailed designs for intermediate photovoltaic systems Warehouse [DE82-014534] p 69 N83-20396

- Intermediate photovoltaic system application experiment operational performance report Volume 5, for Beverly High School, Beverly, Mass [DE82-012058] p 81 N83-22774

ARCTIC REGIONS

- The importance of satisfactory positioning, diving and mapping systems, suitable for exploration and transportation in ice-covered sea areas [FOA-B-60003-M7] p 107 N83-17999

ARGON

- Effect of argon pressure on the optical properties of sputtered solar selective surfaces p 40 A83-22620

ARID LANDS

- Geology and structures study of the Nuba Mountains, Sudan, using Landsat images p 92 A83-24561

- Use of remote sensing techniques to study geothermal resources in arid and semi-arid zones in Chile p 92 A83-24577

AROMATIC COMPOUNDS

- Synthetic-fuel aromaticity and staged combustion [DE82-010302] p 118 N83-19858

ARRAYS

- Wind and turbine characteristics needed for integration of wind turbine arrays into a utility system p 171 N83-19247

- A review of utility issues for the integration of wind electric generators p 173 N83-19269

ARSENIC

- A microprocessor-controlled photovoltaic-array loading unit
[DE83-000797] p 75 N83-21556
- ARSENIC**
Rates and equilibria of devolatilization and trace element evolution in coal pyrolysis
[PB82-260944] p 96 N83-16460
- ARSENIDES**
Potential biological hazards of nickel arsenides associated with retorting of oil shale Toxic effects of particulate Ni₅As₂
[DE82-010978] p 22 N83-19328
- ARTEMIA**
Environmental quality research Fate of toxic jet fuel components in aquatic systems
[AD-A122548] p 30 N83-21168
- ASPHALT**
The design, effectiveness and construction of passive-thermal-control roofing shingles
[DE83-001465] p 75 N83-21557
- ATMOSPHERIC CHEMISTRY**
The seasonal variation of the atmospheric SO₂ to SO₄⁻² conversion rate p 2 A83-24279
Fossil-energy program
[DE82-007502] p 111 N83-18083
- ATMOSPHERIC CIRCULATION**
The influence of large-scale advection on the vertical distribution of stratospheric source gases in 44 degree and 41 degree north p 1 A83-20224
- ATMOSPHERIC COMPOSITION**
Uncertainties of predictions of future atmospheric CO₂ concentrations p 2 A83-24251
Feedback mechanisms in the climate system affecting future levels of carbon dioxide p 2 A83-24252
Exponential growth and atmospheric carbon dioxide p 2 A83-24255
Distribution of and changes in industrial carbon dioxide production p 2 A83-24256
- ATMOSPHERIC EFFECTS**
Propagation at 10 microns through smoke produced by atmospheric combustion of diesel fuel p 3 A83-26641
Heavy Gas Dispersal
[VKI-LS-1982-03] p 200 N83-19316
Introductory lecture Statement of the problem p 200 N83-19317
- ATMOSPHERIC ENTRY**
Reentry thermal testing of light-weight radioisotope heater unit
[DE82-014116] p 148 N83-23147
- ATMOSPHERIC MODELS**
Uncertainties of predictions of future atmospheric CO₂ concentrations p 2 A83-24251
Exponential growth and atmospheric carbon dioxide p 2 A83-24255
General review of wind engineering problems p 114 N83-18944
The effects of atmospheric variability on energy utilization and conservation
[DE83-003612] p 31 N83-21525
- ATMOSPHERIC OPTICS**
Additional solar spectral data sets p 199 A83-25450
- ATMOSPHERIC REFRACTION**
Solar altitude frequency tables p 39 A83-22617
- ATMOSPHERIC TURBULENCE**
Atmospheric turbulence parameters for modeling wind turbine dynamics p 171 N83-19252
Identification of problem areas related to the dispersion of heavy gases p 200 N83-19318
- ATOMIC COLLISIONS**
Energy and Technology Review
[DE82-011840] p 164 N83-16922
- ATOMIZING**
Flames with impinging jets p 91 A83-21423
Design strategy for the combustion of coal-derived liquid fuels
[DE82-905496] p 95 N83-16444
- AUSTENITIC STAINLESS STEELS**
Results of u-bend stress-corrosion-cracking specimen exposures in coal-liquefaction pilot plants
[DE82-012889] p 105 N83-17708
- AUTOMATIC CONTROL**
Application of multivariable systems theory; Symposium, Plymouth, England, October 26-28, 1982, Collected Papers p 151 A83-23171
Dynamic modeling and control analysis of froth flotation and clean-coal filtration as applied to coal beneficiation
[DE82-004555] p 97 N83-16558
Design of highwall mining equipment electronic guidance package
[DE82-006115] p 108 N83-18005
Automation of the longwall mining system
[NASA-CR-169933] p 114 N83-19183
Survey of the international development in indoor climate control
[PB83-100461] p 67 N83-19962

- Proceedings of the 1981 Symposium on Instrumentation and Control for Fossil-energy Processes
[DE82-011999] p 124 N83-20406
- Automated installation methods for photovoltaic arrays
[DE83-004272] p 82 N83-22796
- AUTOMATION**
Preliminary analysis of the state of the art of robotics and precision engineering and evaluation of potential for improved energy utilization in the pulp, paper, and related energy-consuming processes
[DE83-001016] p 21 N83-19294
The investigation of passive blade cyclic pitch variation using an automatic yaw control system
[DE83-000651] p 178 N83-21548
- AUTOMOBILE ENGINES**
Rotary engines p 152 A83-25140
Catalyst durability evaluation for advanced gas turbine engines
[ASME PAPER 82-JPGC-GT-21] p 152 A83-25270
The relative attractiveness of electric and hybrid passenger cars p 3 A83-27159
Acid fuel cell technologies for vehicular power plants p 154 A83-27185
Status of solid polymer electrolyte fuel cell technology and potential for transportation applications p 154 A83-27186
An assessment of the multifuel capability and alternative fuel potential of the automotive Stirling engine /ASE/ p 156 A83-27273
50 kW Stirling engine p 157 A83-27282
Manufacture and testing of fibre composite rotor components /Fibre composite flywheel development program for road vehicle applications/ p 190 A83-27308
Possibilities of improving exhaust emissions and energy consumption in mixed hydrogen-gasoline operation p 87 A83-27334
The assessment of variable valve timing of internal combustion engines for fuel economy improvements and practicability
[PB82-265364] p 5 N83-16766
Computer program for Stirling engine performance calculations
[NASA-TM-82960] p 166 N83-17423
Advanced Gas Turbine (AGT) powertrain system development for automotive applications p 166 N83-17424
[NASA-CR-167983] p 168 N83-18940
Supercharging with Compress p 168 N83-18940
Diesel Emissions Symposium Proceedings
[PB82-244013] p 23 N83-19462
Diesel technology
[GPO-99-748] p 25 N83-20151
Review and evaluation of automotive fuel technologies
Volume 1 Summary
[PB83-101147] p 30 N83-20845
- AUTOMOBILE FUELS**
An assessment of the multifuel capability and alternative fuel potential of the automotive Stirling engine /ASE/ p 156 A83-27273
Trends in motor gasolines, 1942 - 1981
[DE82-021124] p 96 N83-16550
Technical standards for fuel consumption in private automobiles
[DE82-900748] p 106 N83-17735
West Europe report Science and technology, no 133
[JPRS-82608] p 89 N83-17757
LPG, hydrogen Automobile fuels of tomorrow discussed p 89 N83-17758
Motor gasolines, summer 1981
[DE82-014425] p 121 N83-19924
Review and evaluation of automotive fuel conservation technologies
[PB83-101139] p 30 N83-20844
Review and evaluation of automotive fuel technologies
Volume 1 Summary
[PB83-101147] p 30 N83-20845
Assessment of methane-related fuels for automotive fleet vehicles Volume 1 Executive summary
[DE83-000280] p 130 N83-21185
Motor-fuels for road vehicles
[REPT-24] p 140 N83-22440
Lightweight aircraft engines, the potential and problems for use of automotive fuels p 141 N83-22446
Manufacturing comparisons of aviation and motor gasolines p 141 N83-22448
Assessment of methane-related fuels for automotive fleet vehicles Volume 2 Technical, supply and economic assessments
[DE82-013287] p 142 N83-22467
Assessment for methane-related fuels for automotive fleet vehicles Volume 3 Appendices
[DE82-013190] p 142 N83-22468
Annual Transportation Convention, volume 2 Session F Energy and Transportation Engineering Session G Transport Planning
[CSIR-S-313-VOL-2] p 37 N83-23212

- Gasoline shortfall management p 148 N83-23213
Alternative motor fuels p 148 N83-23214
Prospects of motor vehicles as a means of transportation and of alternative drives p 148 N83-23215
Characterization of exhaust emissions from methanol- and gasoline-fueled automobiles
[PB83-116830] p 149 N83-23249
- AUTOMOBILES**
An advanced electric vehicle powertrain p 154 A83-27161
Rationale for advances in the technology of IC engines
[DE82-000264] p 14 N83-17886
Refining studies and engine testing of alternative highway-transportation fuels Identification and evaluation of optimized alternative fuels
[DE83-003332] p 129 N83-21172
Reformed methanol
[DE83-002096] p 129 N83-21176
Study of vacuum systems for a heat engine/flywheel automotive propulsion system
[DE83-002284] p 198 N83-23244
Maintaining automotive mobility Using fuel economy and synthetic fuels to compete with OPEC oil
[DE83-004873] p 37 N83-23245
Synthetic fuels for transportation Background paper 1. The future potential of electric and hybrid vehicles
[PB83-126086] p 37 N83-23250
- AUXILIARY POWER SOURCES**
Rymark 1, Rymark 2, and Rymark 3, Fredenck, Maryland Solar-energy-system performance evaluation, May 1981 through March 1982
[DE83-000067] p 57 N83-16890
Contemporary Systems, Inc., Walpole, New Hampshire solar-energy-system performance evaluation
[DE83-000068] p 57 N83-16894
- AVAILABILITY**
Federal energy conservation programs Perspectives from the public and private sectors Volume 2 Public hearing, July 14 and 15, 1981, Washington, DC
[PB82-238544] p 22 N83-19313
Manufacture, distribution, and handling of nitrate salts for solar-thermal applications
[DE83-003317] p 79 N83-21625
- AXES OF ROTATION**
Simplified aeroelastic modeling of horizontal axis wind turbines
[NASA-CR-168109] p 178 N83-21509
ASI/Pinson 1-kilowatt high-reliability wind system development Phase 1 Design and analysis
[DE82-016128] p 180 N83-21602
Some experiments on Yaw stability of wind turbines with various coning angles
[NASA-CR-168108] p 181 N83-22740
- AXIAL STRESS**
Effect of simulated medium-Btu coal gasifier atmospheres on the biaxial stress rupture behavior of four candidate coal gasifier alloys
[DE82-008607] p 104 N83-17661
- AZO COMPOUNDS**
Photochemical storage potential of azobenzenes
p 191 A83-28941

B

- BALLOON FLIGHT**
Results of the 1982 NASA/JPL balloon flight solar cell calibration program
[NASA-CR-170123] p 72 N83-21510
- BARS**
Seminar on Use of High Strength Deformed Bars
[PB83-122580] p 34 N83-22486
- BATTERY CHARGERS**
Sealed mini-nickel cadmium battery charging techniques, technical investigation report
[AD-A119826] p 192 N83-16860
- BAYS (TOPOGRAPHIC FEATURES)**
Subsea permafrost in Hamson Bay, Alaska An interpretation from seismic data
[AD-A121020] p 125 N83-20479
- BEAMS (RADIATION)**
Stability analysis of flexible wind turbine blades using finite element method
[NASA-CR-168107] p 177 N83-21508
- BEDS (PROCESS ENGINEERING)**
Modeling and evaluation of designs for solid hydrogen storage beds p 87 A83-27333
ASPEN technical reference manual
[DE82-020201] p 112 N83-18325
- BENDING**
Results of u-bend stress-corrosion-cracking specimen exposures in coal-liquefaction pilot plants
[DE82-012889] p 105 N83-17708

BENDING MOMENTS

Development of an oscillating-vane concept as an innovative wind-energy-conversion system
[DE82-012870] p 179 N83-21599

BENEFICIATION

Dynamic modeling and control analysis of froth flotation and clean-coal filtration as applied to coal beneficiation
[DE82-004555] p 97 N83-16558

BENZENE

Photochemical storage potential of azobenzenes
p 191 A83-28941

BERING SEA

Dissolved methane concentrations in the southeast Bering Sea, 1980 and 1981
[PB83-112433] p 29 N83-20525

BIBLIOGRAPHIES

Amorphous silicon bibliography update - Introduction
p 41 A83-22915

Energygrams Brief descriptions of energy technology
[DE82-003278] p 199 N83-16891

Energygrams Brief descriptions of energy technology
[DE82-003277] p 199 N83-16892

Overview of existing residential energy-efficiency rating systems and measuring tools
[DE83-003148] p 20 N83-19289

Waste lubricating oil An annotated review, 1982 revision
[DE83-001439] p 30 N83-21156

BINARY FLUIDS

Some basic research problems related to energy
[DE83-003753] p 195 N83-21527

Evaluation of ammonia as a working fluid for a wet/dry-cooled binary geothermal plant
[DE83-002895] p 135 N83-21631

Irrigation pumping using geothermal energy
[DE83-005308] p 135 N83-21641

BINARY MIXTURES

Thermodynamic properties for natural gas binaries
[PB82-254616] p 98 N83-16565

BINARY SYSTEMS (MATERIALS)

Performance and operational experience of a prototype binary geothermal power plant
[DE82-006289] p 164 N83-16901

BIOASSAY

Short-Term Bioassays in the Analysis of Complex Environmental Mixtures 2
[PB82-233172] p 23 N83-19420

Environmental quality research Fate of toxic jet fuel components in aquatic systems
[AD-A122548] p 30 N83-21168

BIOCONVERSION

Solar power applications - Alcohols
p 39 A83-21066

Municipal-solid-waste biconversion technologies
[DE83-000263] p 100 N83-16893

Methane from landfills Preliminary assessment workbook
[DE83-002319] p 111 N83-18075

BIOLOGICAL EFFECTS

A preliminary study of environmental parameters associated with the feasibility of a polygeneration plant at Kennedy Space Center
p 11 N83-17365

Potential biological hazards of nickel arsenides associated with retorting of oil shale Toxic effects of particulate Ni5As2
[DE82-010978] p 22 N83-19328

Electric power from orbit A critique of a satellite power system
[DE83-002771] p 33 N83-21619

BIOMASS

Collection, transportation, and storage of biomass residues in the Pacific Northwest
[DE82-004737] p 100 N83-16887

Microorganisms for fermentation of crop residues
[DE82-006912] p 102 N83-17051

Pacific Northwest biomass as an energy resource
[DE82-005804] p 110 N83-18047

Energy inputs and outputs of fuel-alcohol production, appendices C through F Methanol from cellulose
[DE83-000369] p 130 N83-21178

Energy from biomass Land analysis and evaluation of supply models
[DE83-003333] p 132 N83-21524

BIOMASS ENERGY PRODUCTION

Manne power - Accomplishments of the 1970s
p 155 A83-27223

Test report on the combustion of PERC and LBL wood oils
[DE82-004485] p 95 N83-16429

Bench scale research in biomass direct liquefaction
[DE82-005228] p 100 N83-16905

Biomass cogeneration A business assessment
[DE82-011773] p 101 N83-16928

Health and safety issues of alternate energy systems
[DE82-002918] p 9 N83-16959

Penetration and air-emission-reduction benefits of solar technologies in the electric utilities
[DE82-002637] p 9 N83-16971

Programmatic environmental overview Biomass fuels program
[DE82-006065] p 101 N83-16975

Methanol synthesis gas from catalytic steam reforming of wood
[DE82-006082] p 106 N83-17734

Design, construction, operation and costs of a modern small-scale fuel-alcohol plant
[DE82-011019] p 107 N83-17754

Catalyst behavior in biomass gasification -- wood
[DE82-006164] p 110 N83-18057

Catalytic gasification of biomass
[DE82-005877] p 110 N83-18058

Entrained flow, ablative fast pyrolysis of biomass
[DE82-005791] p 113 N83-18875

Gasification of land-based biomass
[PB83-109918] p 122 N83-19946

The utilization of emergent aquatic plants for biomass-energy-systems development
[DE82-009174] p 124 N83-20395

Direct liquefaction of biomass Results from operation of continuous bench scale unit in liquefaction of water slurries of Douglas fir wood
[DE82-015703] p 124 N83-20414

Catalyzed steam gasification of biomass Phase 3 Biomass Process Development Unit (PDU) construction and initial operation
[DE82-010264] p 124 N83-20415

SNG from land-based biomass 1981 program
[PB83-10467] p 125 N83-20440

National implications of high solar and biomass energy growth A technology assessment of solar energy systems
The TASE Project
[DE83-004935] p 34 N83-21638

Flash pyrolysis of biomass with reactive and non-reactive gases
[DE83-001850] p 137 N83-22336

Marine biomass New York state site and species study compositional analysis and systems studies
[PB83-126078] p 142 N83-22470

The engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc. at Thibodaux, Louisiana Attachment A Volume 2 Definition of facilities and scope of work for an ethanol facility to be located at Thibodaux, Louisiana
[DE83-001165] p 147 N83-22829

BIOMEDICAL DATA
Biostatistics and health impacts of energy technologies
p 36 N83-22962

BIOSYNTHESIS
Methanol production from fermentor off-gases
[DE83-005011] p 145 N83-22793

BIOTECHNOLOGY
West Europe report Science and technology, no 134
[JPRS-82686] p 199 N83-17761

BIPOLARITY
Bipolar lead accumulator cell with high energy density
[PB82-258757] p 193 N83-16934

BISMUTH COMPOUNDS
Photoelectrochemical processes in bismuth germanium oxide, Bi12GeO20 single crystals
p 38 A83-20581

BISMUTH SULFIDES
Photoelectrochemical behaviour of electrodeposited and pressure-sintered Bi2S3, Bi2S3-PbS and Bi2S3-Ag2S semiconductor electrodes
p 40 A83-22905

BITUMENS
Coal
p 143 N83-22675

BLANKETS (FUSION REACTORS)
HYFIRE A Tokamak/high-temperature electrolysis system
[DE82-013851] p 90 N83-23173

BOATS
Feasibility evaluation of fuel cells for selected heavy-duty transportation systems
[DE83-002953] p 179 N83-21550

BOILERS
Regulation of a system with variable structure -- for boilers of solar powered central receivers
p 43 A83-24761

Volatile production during preignition coal heating
[DE82-011241] p 95 N83-16445

Investigation of methanol as a boiler fuel for electric-power generation
[DE82-905495] p 97 N83-16560

Operational experiences of a downhole steam generator
[DE82-010161] p 100 N83-16906

Combustion of solvent-refined coal in a 100 HP firetube boiler
[DE82-007670] p 103 N83-17640

Practical and theoretical analysis of continuous selection of temperature layers in a hot tank by an experimental tank and a simulation model
[BMFT-FB-T-82-171] p 13 N83-17842

Construction and operation of a central heating plant prototype heated by coal dust corresponding to the Schoppe system
[BMFT-FB-T-82-176] p 109 N83-18031

State-of-the-art combustion modification NOx control for stationary combustion equipment
[PB82-240201] p 23 N83-19340

Transport characteristics of alternate slurry fuels
[DE82-013508] p 121 N83-19939

Flow distribution control characteristics in manne gas turbine waste-heat recovery system Phase 2 Flow distribution control in waste-heat steam generators
[AD-A119310] p 175 N83-20054

Survey of large combustors Alternative fuel burning capabilities of large boilers in 1979
[DE82-008386] p 127 N83-21079

SRC-I project Baseline
[DE83-000987] p 127 N83-21086

Utilization of secondary energy resources at Magnitogorsk Metallurgical Combine
[BLL-M-26856-(5828 4)] p 131 N83-21502

A technology assessment of solar energy systems Direct combustion of wood and other biomass in industrial boilers
[DE83-000937] p 31 N83-21538

Oil/refuse homogenization An approach to combustion of refuse in existing oil-fired boilers
[DE82-011848] p 138 N83-22353

Converting small industrial boilers to burn wood fuels
[PB83-128116] p 147 N83-22844

BOLTS
A study of bolting problems, tools, and practices in the nuclear industry
[DE82-902203] p 168 N83-19099

BONDING
Developments and applications of tantalum thin films and hybrid technology
[BMFT-FB-T-82-173] p 199 N83-17686

BOREHOLES
Colorado geothermal resource assessment Shallow-hole temperature survey Intermediate-depth holes IGH no 1 and no 2, Depth test hole 44X-10
[DE83-002898] p 135 N83-21621

The HFEM monitoring of coal gasification Rawlins, Wyoming
[DE82-013801] p 142 N83-22466

BOROSILICATE GLASS
Graded-index antireflective coatings for glass
[DE82-016756] p 67 N83-19917

BOUNDARY LAYER COMBUSTION
Laser fluorescence measurements of the OH concentration in a combustion boundary layer
p 86 A83-24367

Experimental investigation of shock initiated methane-combustion near a wall
p 93 A83-26200

BOUNDARY LAYER PLASMAS
MHD channel electrical boundary-layer theory and applications
p 151 A83-23131

BRAYTON CYCLE
Characteristics of a closed Brayton cycle piston engine
p 151 A83-23135

The design and construction of a low power gas turbine for solar energy conversion - An analytical model of operation of the installation in a variable mode -- French thesis
p 52 A83-28647

The 1-MW(th) solar-thermal conversion full-system experiment
[DE82-906454] p 59 N83-16920

Solar/gas Brayton/Rankine cycle heat pump assessment
[PB83-102319] p 67 N83-19963

Centaur gas-turbine modification and development for solar-fossil hybrid operation
[DE83-900192] p 177 N83-21366

BRAZING
Applications of ion beam technology
[NASA-CR-169797] p 88 N83-16493

BREMSSTRAHLUNG
Laser-plasma interaction experiments at laser wavelengths of 1.064 micron, 0.532 micron and 0.355 micron
[DE82-013992] p 175 N83-20114

BRIDGES (STRUCTURES)
Seminar on Use of High Strength Deformed Bars
[PB83-122580] p 34 N83-22486

BRILLOUIN EFFECT
Laser-plasma interaction experiments at laser wavelengths of 1.064 micron, 0.532 micron and 0.355 micron
[DE82-013992] p 175 N83-20114

BRINES

Organic rankine cycle coupled to a solar pond by direct-contact heat exchange - selection of a working fluid

[DE82-020998] p 57 N83-16900

Oxygen isotope exchange in rocks and minerals from the Cerro Prieto geothermal system Indicators of temperature distribution and fluid flow

[DE82-001077] p 100 N83-16907

Investigation of the geothermal potential of the UK The Southampton (Western Esplanade) geothermal well A preliminary assessment of the resource

p 109 N83-18029

Experience in testing of a solution mined storage cavern

[DE82-011013] p 113 N83-18464

Localized corrosion in materials for geothermal power

[DE82-015608] p 128 N83-21136

BROADCASTING

Solar-photovoltaic power for broadcasting stations An economic analysis

[DE82-022498] p 55 N83-16873

BROMINE

Health and environmental effects document for batteries, 1981 The zinc/halogen batteries

[DE82-006987] p 23 N83-19331

BUBBLES

Design considerations in the use of Glauber salt for energy storage

[DE82-019289] p 192 N83-16868

BUILDINGS

Energy audits at 48 hospitals

[DE82-002814] p 5 N83-16884

Analysis of energy use at US institutional buildings

[DE82-004670] p 6 N83-16886

Commercial building design and energy conservation A preliminary assessment

[DE82-008581] p 17 N83-18067

General review of wind engineering problems

p 114 N83-18944

Energy and life-cycle cost analysis of a six-story office building

[DE82-004840] p 20 N83-18963

Residential and commercial cogeneration systems assessment

[PB82-240037] p 22 N83-19314

District heating and more-efficient buildings

[DE81-025437] p 26 N83-20379

On-site fuel cell field test support program

[PB83-121723] p 28 N83-20439

Performance criteria for solar heating and cooling systems in residential buildings

[PB83-122663] p 85 N83-22843

BURNERS

Particulate processes in pulverized-coal flames

[DE82-014306] p 140 N83-22367

Multi-fuel low-NOx burner development, phase 2

[PB83-126292] p 147 N83-22845

BURNING RATE

Laminar burning velocities of hydrogen-air and hydrogen-air-steam flames

p 85 A83-19837

Combustion of oil on water An experimental program

[DE82-014598] p 127 N83-21084

BUTENES

Viscometric and misting properties of polymer-modified fuel

[NASA-CR-169750] p 96 N83-16543

BYPASSES

Solar array power management --- in spacecraft power supplies

p 46 A83-27148

Shading analysis of a photovoltaic-cell string illuminated by a parabolic-trough concentrator

[DE83-002646] p 74 N83-21537

C

CABLES (ROPES)

High-temperature geothermal cableheads

[DE82-005864] p 117 N83-19302

CADMIUM COMPOUNDS

A semiconductor-insulator-semiconductor CdO-SiO₂-Si solar cell

p 41 A83-22912

CADMIUM SELENIDES

Electrophoretically deposited CdS and CdSe anodes for photoelectrochemical cells

p 149 A83-19883

Electrochemical solar cells using CdSe thin film electrodes

p 37 A83-19885

Chemical bath deposition of thin film cadmium selenide for photoelectrochemical cells

p 38 A83-20594

Factors affecting the efficiency of chemically deposited CdSe based photoelectrochemical cells

p 54 A83-29514

CADMIUM SULFIDES

Electrophoretically deposited CdS and CdSe anodes for photoelectrochemical cells

p 149 A83-19883

Development of copper sulfide/cadmium sulfide thin-film solar cells

[DE83-001421] p 74 N83-21539

Photovoltaic advanced research and development program in the United States

[DE83-000307] p 83 N83-22814

CALCIUM CHLORIDES

Flue gas desulfurization with waste water evaporation

Phase 2 Observation of the experiments at Weiher II

[BMFT-FB-T-82-026] p 125 N83-21053

CALCIUM COMPOUNDS

An evaluation of hydrated calcium aluminate compounds as energy storage media

[PB82-249921] p 194 N83-19308

CALCIUM OXIDES

CaO interactions in the staged combustion of coal

[DE82-010299] p 103 N83-17641

Coal-gasification and tar-conversion reactions over calcium oxide

[DE82-014635] p 139 N83-22358

CALCIUM SULFIDES

CaO interactions in the staged combustion of coal

[DE82-010299] p 103 N83-17641

CALIBRATING

Results of the 1982 NASA/JPL balloon flight solar cell calibration program

[NASA-CR-170123] p 72 N83-21510

CALIFORNIA

Geothermal energy Opportunities for California

commerce, phase 1 report

[DE82-009121] p 110 N83-18066

CALORIMETERS

New physical-chemical reactions useful for TES

[DE82-020807] p 195 N83-20432

CAMERAS

Photovoltaic 1-5 curve measurement techniques

[DE83-000447] p 80 N83-22534

CANCER

Biostatistics and health impacts of energy technologies

p 36 N83-22962

CAPACITANCE

Al-Si peaked Schottky barriers

p 40 A83-22903

CAPACITORS

Parametric investigations and other related studies of energy storage type capacitors

[DE83-003426] p 197 N83-22785

CARBON DIOXIDE

Thermodynamic properties for natural gas binaries

[PB82-254616] p 98 N83-16565

Development of the utilization of combustible gas produced in existing sanitary landfills

Effects of corrosion at the Mountain View, California landfill gas-recovery plant

[DE83-001576] p 145 N83-22769

Methanol production from fermentor off-gases

[DE83-005011] p 145 N83-22793

CARBON DIOXIDE CONCENTRATION

Uncertainties of predictions of future atmospheric CO₂ concentrations

p 2 A83-24251

Feedback mechanisms in the climate system affecting future levels of carbon dioxide

p 2 A83-24252

Exponential growth and atmospheric carbon dioxide

p 2 A83-24255

Distribution of and changes in industrial carbon dioxide production

p 2 A83-24256

CARBON FIBER REINFORCED PLASTICS

Study on composite flywheels for energy storage

p 188 A83-22701

CARBON FIBERS

Applications of ion beam technology

[NASA-CR-169797] p 88 N83-16493

CARBONACEOUS MATERIALS

Fossil-energy

[DE83-003817] p 124 N83-20383

Alaskan coal Resources and developmental constraints

[DE83-000860] p 130 N83-21494

CARBONATES

Molten carbonate fuel cell performance model

p 149 A83-19884

Simple porous electrode models for molten carbonate fuel cells

p 149 A83-19891

Porous perovskite electrode as molten carbonate cathode --- in fuel cells

p 150 A83-20596

Coating applications for the molten carbonate fuel cell

p 153 A83-25538

Hot-gas cleanup for molten-carbonate fuel cells

[DE82-002500] p 163 N83-16864

Electromigrational composition gradients in molten carbonates A review

[DE83-002593] p 177 N83-21075

CARRIER DENSITY (SOLID STATE)

A model for the collection of minority carriers generated in the depletion region of a Schottky barrier solar cell

p 40 A83-22910

CARRIER TRANSPORT (SOLID STATE)

Effect of grain boundaries on the minority carrier diffusion length in InP solar cells

p 40 A83-22908

Grain boundary effects in polycrystalline silicon solar cells I - Solution of the three-dimensional diffusion equation by the Green's function method II - Numerical calculation of the limiting parameters and maximum efficiency

p 52 A83-27981

Diffusion length determination in n+/p-p+/p+ structure based silicon solar cells from the intensity dependence of the short-circuit current for illumination from the p+/p+ side

p 52 A83-27982

CARTS

High production shuttle car system for coal mines

[NASA-CASE-NPO-15949-1] p 187 N83-20155

CATALOGS (PUBLICATIONS)

Federal Technology Catalog 1982 Summaries of practical technology

[PB83-121533] p 200 N83-22480

CATALYSIS

Mass transfer and chemical reaction of gaseous species in non-catalytic and catalytic porous media supporting catalytic and non-catalytic liquids

[DE82-021713] p 95 N83-16427

Applications of ion beam technology

[NASA-CR-169797] p 88 N83-16493

Catalyzed steam gasification of biomass Phase 3 Biomass Process Development Unit (PDU) construction and initial operation

[DE82-010264] p 124 N83-20415

CATALYSTS

Steam gasification of wood in the presence of catalysts

[DE82-005919] p 162 N83-16557

Catalytic effects of alkali metal salts in the gasification of coal char

[DE82-000850] p 103 N83-17645

Catalytic coal gasification An emerging technology for SNG

[DE82-007596] p 104 N83-17676

Catalyst behavior in biomass gasification --- wood

[DE82-006164] p 110 N83-18057

Catalytic gasification of biomass

[DE82-005877] p 110 N83-18058

Prospects for the development of non-noble metal catalysts for hydrogen-air fuel cells

[DE82-013875] p 176 N83-20422

Desulfurization with transition metal catalysts

[DE83-003062] p 126 N83-21071

Catalytic coal liquefaction

[DE83-001098] p 127 N83-21078

Effects of several disposable catalysts on liquefaction of lignite

[DE82-022188] p 138 N83-22351

Catalytic evaluation for H-coal

[DE82-014457] p 138 N83-22355

Catalytic coal liquefaction

[DE82-012562] p 139 N83-22363

Catalytic coal conversion support Use of laser flash-pyrolysis for structural analysis

[DE82-014124] p 139 N83-22366

Dynamic simulation of Exxon's Catalytic Coal-Gasification process

[DE82-021973] p 146 N83-22823

CATALYTIC ACTIVITY

Catalyst durability evaluation for advanced gas turbine engines

[ASME PAPER 82-JPGG-GT-21] p 152 A83-25270

Catalytic combustion with steam injection

[ASME PAPER 82-JPGG-GT-23] p 93 A83-25271

Methanol synthesis gas from catalytic steam reforming of wood

[DE82-006082] p 106 N83-17734

Rationale for advances in the technology of IC engines

[DE82-000264] p 14 N83-17886

Combustion engine system

[NASA-CASE-NPO-14565-2] p 89 N83-19826

Desulfurization with transition-metal catalysis

[DE82-013964] p 118 N83-19853

Chemistry and catalysis of coal liquefaction Catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels

[DE82-012474] p 119 N83-19870

Critical research and advanced technology (CRT) support project

[NASA-TM-83019] p 123 N83-20361

Continuously adjustable low-power gasifier burner/boiler system

[BMFT-FB-T-82-038] p 131 N83-21507

Catalytic hydrogenation unit studies

[DE83-003390] p 137 N83-22342

Catalytic coal liquefaction

[DE82-012562] p 139 N83-22363

- CAVES**
Experience in testing of a solution mined storage cavern
[DE82-011013] p 113 N83-18464
Aquifer compressed-air field experiment at Pittsfield, Illinois
[DE83-002057] p 198 N83-22805
- CELL ANODES**
Effect of manganese additions on the performance of aluminum air-battery anode alloys
[DE83-002277] p 196 N83-21629
- CELL CATHODES**
Porous perovskite electrode as molten carbonate cathode --- in fuel cells p 150 A83-20596
- CELLULOSE**
Evaluation of production version of the NASA improved inorganic-organic separator
[NASA-TM-83018] p 166 N83-18022
- CENTRAL NERVOUS SYSTEM**
Study of psychophysiological distinctions of primates using delayed reaction test p 85 N83-26442
- CENTRIFUGAL COMPRESSORS**
18.1 pressure ratio axial/centrifugal compressor demonstration program p 161 A83-29013
- CERAMICS**
Advanced Gas Turbine (AGT) powertrain system development for automotive applications
[NASA-CR-167983] p 166 N83-17424
Fiat researchers study ceramics applications in diesels p 199 N83-17760
Solar-energy treatment of ceramic tiles
[DE83-000147] p 65 N83-19296
Analysis of thermal and mechanical stresses in the ceramic seal of the 1-MW(th) bench model solar receiver
[DE82-901870] p 67 N83-20298
Ceramic heat-exchanger applications study
[DE83-003166] p 132 N83-21529
- CAESIUM PLASMA**
The plasmadynamics and ionization kinetics of thermionic energy conversion
[DE82-012938] p 176 N83-20421
- CHALCOGENIDES**
Investigation of intercalated compounds for photoelectrochemical energy storage
[DE83-000543] p 192 N83-16899
Chalcogenophosphate photoelectrodes
[NASA-CASE-LAR-12958-1] p 60 N83-18025
Chalcogenide-glass solar cells
[DE82-021243] p 68 N83-20382
- CHAMBERS**
A technology assessment of solar energy systems
Direct combustion of wood and other biomass in industrial boilers
[DE83-000937] p 31 N83-21538
- CHARACTERIZATION**
Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery
[DE82-008705] p 140 N83-22436
- CHARGE CARRIERS**
Influence of diffusion of hot carriers on collection efficiency of solar cells - a-Si H p 42 A83-23665
Semiconductor photoelectrochemistry
[NASA-TP-2088] p 167 N83-18024
- CHARGE DISTRIBUTION**
Semiconductor photoelectrochemistry
[NASA-TP-2088] p 167 N83-18024
- CHARGE TRANSFER**
Semiconductor photoelectrochemistry
[NASA-TP-2088] p 167 N83-18024
Flash photoelectrochemical studies of transient electrode processes important in solar-energy conversion
[DE83-003134] p 76 N83-21560
- CHEMICAL ANALYSIS**
Chemical effects in vaporizing synthetic fuels
[DE82-003352] p 96 N83-16549
Guidelines for sampling and analyzing solutions for aquifer thermal-energy-storage systems
[DE83-001852] p 10 N83-16973
Relationship between pyrite formation and organic sulfur content of coal as revealed by electron microscopy
[DE82-010417] p 104 N83-17652
Leachate-treatment technique utilizing fly ash as low-cost sorbent
[DE82-010501] p 111 N83-18101
High performance liquid chromatographic hydrocarbon group-type analyses of mid-distillates employing fuel-derived fractions as standards
[NASA-TM-83072] p 120 N83-19920
Motor gasolines, summer 1981
[DE82-014425] p 121 N83-19924
- CHEMICAL BONDS**
Exploratory study of coal conversion chemistry
[DE82-013414] p 138 N83-22354
- CHEMICAL COMPOSITION**
Physical chemistry of molten-salt batteries
Current-induced composition gradients in molten LiCl-KCl
[DE83-001684] p 192 N83-16875
Chemical characterization of organic contaminants in groundwater near an underground coal gasification site
[DE82-004822] p 8 N83-16956
Relationships between coal constitution, thermoplastic properties and liquefaction behavior of coals and vitrinite concentrates from the lower Kittanning seam, part 1
[DE82-012848] p 118 N83-19860
Liquid fossil-fuel technology
[DE83-002501] p 121 N83-19937
- CHEMICAL ENERGY**
Stored chemical energy propulsion system for underwater applications
[AIAA PAPER 81-1601] p 188 A83-23132
Photo-induced electron-transfer reactions in heterogeneous media
[DE82-005767] p 66 N83-19627
- CHEMICAL ENGINEERING**
West Europe report Science and technology, no. 134
[JPRS-82686] p 199 N83-17761
- CHEMICAL EQUILIBRIUM**
The equilibrium constant for the reversible reaction $H_2S + 3H_2O + 7LiO \rightleftharpoons 66K_0 34/2 CO_3$ yields $4H_2 + CO_2 + 7LiO 66K_0 34/2 SO_4$ at elevated temperature --- in molten carbonate fuel cells p 150 A83-20590
Phase equilibrium properties of coal derived liquids
[DE82-007006] p 102 N83-17638
- CHEMICAL PROPERTIES**
Partial liquefaction of coal by flash hydropyrolysis, phase 4
[DE83-002167] p 127 N83-21085
Toxicology of coal gasification Chemical characterization p 148 N83-22960
- CHEMICAL REACTIONS**
Reversible chemical reactions for energy storage in a large-scale heat utility p 51 A83-27315
Coal gasification for stationary gas-turbine applications
[DE82-902135] p 97 N83-16553
Design considerations in the use of Glauber salt for energy storage
[DE82-019289] p 192 N83-16868
CaO interactions in the staged combustion of coal
[DE82-010299] p 103 N83-17641
Catalytic effects of alkali metal salts in the gasification of coal char
[DE82-000850] p 103 N83-17645
Trace and minor element reactions in fluidized-bed combustion processes
[PB82-240219] p 113 N83-18883
New physical-chemical reactions useful for TES
[DE82-020807] p 195 N83-20432
Selecting and testing oxygen-measuring systems for fluidized-bed combustors
[DE83-005987] p 128 N83-21089
Reformed methanol
[DE83-002096] p 129 N83-21176
Development and demonstration of process and components for the control of aluminum-air-battery electrolyte composition through the precipitation of aluminum trihydroxide
[DE83-002490] p 180 N83-21623
Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery
[DE82-008705] p 140 N83-22436
Nickel-zinc batteries
[DE83-000208] p 197 N83-22770
- CHEMICAL REACTORS**
Design of a vortex-flow solar chemical reactor
[DE83-000031] p 58 N83-16914
Theoretical and experimental studies of fixed-bed coal gasification reactors
[DE82-009515] p 104 N83-17655
Partial liquefaction of coal by flash hydropyrolysis
[DE83-001145] p 126 N83-21077
- CHLORIDES**
Hot-gas cleanup for molten-carbonate fuel cells
[DE82-002500] p 163 N83-16864
Study to establish cost predictions for the production of Redox chemicals
[NASA-CR-167882] p 194 N83-20359
- CHLORINE**
Heavy Gas Dispersal
[VKI-LS-1982-03] p 200 N83-19316
- CHROMATOGRAPHY**
Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery
[DE82-008705] p 140 N83-22436
- CHROMIUM**
Long term solar irradiation heating of black chrome
[DE83-000032] p 58 N83-16909
- Replacement of lumpy chrome ore by agglomerated ore concentrates and lowering of specific power consumption and improvement of Cr yield by means of improved slag composition in the production of HC ferrochrome
[BMFT-FB-T-82-084] p 7 N83-16929
Solar-collector materials exposure to the IPH site environment Task 5.0
[DE83-002192] p 62 N83-18072
Study to establish cost predictions for the production of Redox chemicals
[NASA-CR-167882] p 194 N83-20359
- CHROMIUM OXIDES**
Variation in the microstructure of electrodeposited black chrome solar coatings
[DE81-030842] p 56 N83-16878
- CHROMIUM STEELS**
Evaluation of deterioration due to hot creep in chrome-molybdenum ferritic steels used in thermal power stations
[BLL-CE-TRANS-7669-(9022 09)] p 162 N83-16470
- CITIES**
Ignition sources of LNG vapor clouds
[PB82-262577] p 96 N83-16461
Cogeneration in Municipalities Proceedings from Workshops for Local Governments and Municipal Utilities
[DE82-905758] p 6 N83-16921
Assessment of battery buses and battery technology
[PB82-260019] p 11 N83-17428
Putting renewable energy to work in cities
[DE82-016178] p 27 N83-20427
Geothermal feasibility study for City of Sonoma, California four municipal buildings
[DE82-015115] p 133 N83-21589
- CIVIL AVIATION**
Symposium on Commercial Aviation Energy Conservation Strategies Papers and presentations
[AD-A107106] p 11 N83-17455
Fuel conservation and economy constraints p 34 N83-22179
Aviation Gasolines and Future Alternatives
[NASA-CP-2267] p 140 N83-22442
- CLADDING**
Reentry thermal testing of a general purpose heat source fueled clad
[DE82-014125] p 184 N83-23146
- CLASSIFICATIONS**
Ownership and usage of small passenger vehicles
Findings from the 1977 National Personal Transportation Study
[DE82-011045] p 20 N83-18592
Energy from biomass Land analysis and evaluation of supply models
[DE83-003333] p 132 N83-21524
- CLEAN ENERGY**
Advances in wind energy technology
[DGLR PAPER 82-082] p 151 A83-24194
National project of new energy development in Japan p 48 A83-27243
- CLEANING**
Performance degradation and cleaning of photovoltaic arrays p 48 A83-27236
Evaluation of gasification and gas-cleanup processes for use in molten-carbonate fuel-cell power plants
[DE82-012244] p 167 N83-18084
Flue gas desulfurization with waste water evaporation Phase 2 Observation of the experiments at Weiher II
[BMFT-FB-T-82-026] p 125 N83-21053
- CLEARANCES**
A way to relax the dimensional tolerance requirements of clearance regenerators --- in small Stirling engine design p 158 A83-27286
Effects of displacer seal clearance on free-piston Stirling engine performance p 158 A83-27295
- CLEAVAGE**
Desulfurization with transition-metal catalysis
[DE82-013964] p 118 N83-19853
- CLIMATE**
Meeting the challenge of climate
[PB83-106443] p 29 N83-20511
Alaskan coal Resources and developmental constraints
[DE83-000860] p 130 N83-21494
Assessment of distributed photovoltaic electric-power systems
[DE83-900531] p 75 N83-21558
- CLIMATOLOGY**
Feedback mechanisms in the climate system affecting future levels of carbon dioxide p 2 A83-24252
Meeting the challenge of climate
[PB83-106443] p 29 N83-20511
Energy from biomass Land analysis and evaluation of supply models
[DE83-003333] p 132 N83-21524

CLOSED CYCLES

- Characteristics of a closed Brayton cycle piston engine p 151 A83-23135
Parametric analysis of closed cycle magnetohydrodynamic (MHD) power plants [NASA-CR-165472] p 182 N83-22748

CLOUD COVER

- Mesoscale mapping of available hourly solar irradiance by use of data collected by 'Meteosat' p 43 A83-24633

- A probability density function for the clearness index, with applications p 53 A83-28938

CLOUDS

- Heavy Gas Dispersal [VKI-LS-1982-03] p 200 N83-19316
Introductory lecture Statement of the problem p 200 N83-19317
Flame acceleration mechanisms under conditions of partial confinement [PB83-109884] p 120 N83-19881

COAL

- Volatile production during preignition coal heating [DE82-011241] p 95 N83-16445
Dynamic modeling and control analysis of froth flotation and clean-coal filtration as applied to coal beneficiation [DE82-004555] p 97 N83-16558
Coal-waste artificial-reef program, phase 3 Volume 2 Comprehensive report p 8 N83-16954
A study of the United States coal resources [NASA-CR-169792] p 101 N83-16993
Characteristics of coal/light hydrocarbon slurries in spray combustion p 102 N83-17639
CaO interactions in the staged combustion of coal [DE82-010299] p 103 N83-17641
Relationship between pyrite formation and organic sulfur content of coal as revealed by electron microscopy [DE82-010417] p 104 N83-17652
Fuel-composition and -vaporization effects on combustion-chamber deposits p 104 N83-17670
Construction and operation of a central heating plant prototype heated by coal dust corresponding to the Schoppe system [BMFT-FB-T-82-176] p 109 N83-18031
Perspectives in Geology Invited papers presented at a symposium in observance of the 75th anniversary of the Illinois State Geological Survey [PB-255589] p 112 N83-18138
The Illinois State Geological Survey The next quarter century p 112 N83-18139
Coal geology Who needs it? p 112 N83-18140
Ultrasonically enhanced size reduction of coal [DE82-008679] p 113 N83-18416
Automation of the longwall mining system [NASA-CR-169933] p 114 N83-19183
Hybrid fuel cell/diesel generation total energy system, part 2 [NASA-CR-169912] p 115 N83-19217
Coal pyrolysis by hot solids from a fluidized-bed combustor p 117 N83-19829
Coal desulfurization by a microwave process [DE82-007514] p 118 N83-19854
Relationships between coal constitution, thermoplastic properties and liquefaction behavior of coals and vitrinite concentrates from the lower Kittanning seam, part 1 [DE82-012848] p 118 N83-19860
Pipeline gas from coal Hydrogenation (IGT hydrogenation process) [DE82-014611] p 121 N83-19941
High production shuttle car system for coal mines [NASA-CASE-NPO-15949-1] p 187 N83-20155
Review of Thawtron device for thawing frozen coal [DE82-903145] p 123 N83-20330
Transportation network models for energy supply analysis Volume 1 Executive summary [DE82-903077] p 187 N83-20399
Transportation network models for energy supply analysis Volume 3 Transportation network model user's guide and documentation [DE82-903079] p 187 N83-20400
International energy indicators [DE82-012504] p 26 N83-20405
Basic combustion and pollutant-formation processes for pulverized fuels [DE82-013773] p 29 N83-20457
Desulfurization of solid fuels in power stations by superconductive magnets [BLL-CE-TRANS-7855-9022 09] p 125 N83-21051
Enlargement of the raw material basis of refineries by including hard coal Pilot plant for coal hydrogenation, construction phase [BMFT-FB-I-82-192] p 126 N83-21054

- Survey of large combustors Alternative fuel burning capabilities of large boilers in 1979 [DE82-008386] p 127 N83-21079

- Alaskan coal Resources and developmental constraints [DE83-000860] p 130 N83-21494
Electric home heating Substitution for oil and gas [DE82-013762] p 133 N83-21581

- Acid precipitation A critique of present knowledge and proposed action [DE83-900303] p 34 N83-21650
Particulate processes in pulverized-coal flames [DE82-014306] p 140 N83-22367

- Workshop report on Basic Research in Organic Geochemistry Applied to National Energy Needs [DE82-007074] p 144 N83-22760
Exploitation deliberations p 144 N83-22763
The relevance of coal geochemistry to coal utilization p 144 N83-22767

- Conversion of coal to synthetic fuels p 144 N83-22768

- Assessment of the need for dry cooling, 1981 update [DE82-009395] p 146 N83-22803

COAL DERIVED GASES

- Development and application of advanced diagnostics methods in fossil fuel combustion studies p 90 A83-20436
H-Coal Pilot Plant Phase 2 Construction and Phase 3 Operation [DE82-005117] p 106 N83-17732

- Transco medium-Btu coal gasification project Feasibility study, volume 1 [DE82-009597] p 119 N83-19872

- Transco medium-Btu coal gasification project Feasibility study, volume 2 [DE82-009596] p 119 N83-19873

- Transco medium-Btu coal gasification project Feasibility study, volume 3 [DE82-009595] p 120 N83-19874

- Critical research and advanced technology (CRT) support project [NASA-TM-83019] p 123 N83-20361

COAL DERIVED LIQUIDS

- The properties of fuel fractions obtained by the hydrogenation of Kansk-Achinsk coal p 94 A83-26920

- Design strategy for the combustion of coal-derived liquid fuels [DE82-905496] p 95 N83-18444

- Nonstandard aging tests on coal-derived distillate fuels [DE82-010442] p 97 N83-16562

- Development of statistical databases for toxicological studies [DE82-005196] p 10 N83-17067

- Phase equilibrium properties of coal derived liquids [DE82-007006] p 102 N83-17638

- Solvent-Refined-Coal (SRC) Process Coking of SRC-2 process streams Part 3 Effects of coal minerals on coking Part 4 Thermal properties of SRC-2 cokes and process streams [DE82-012369] p 104 N83-17657

- The use of slurry fuels in industrial furnaces [TAE-428] p 106 N83-17729

- H-Coal Pilot Plant Phase 2 Construction and Phase 3 Operation [DE82-005117] p 106 N83-17732

- Studies of the mechanisms of turbine fuel instability [NASA-CR-167963] p 114 N83-18924

- EDS coal-liquefaction process development Phase 5 EDS product quality [DE83-002226] p 117 N83-19827

- Desulfurization with transition-metal catalysts [DE82-013964] p 118 N83-19853

- Proceedings of the 1981 Symposium on Instrumentation and Control for Fossil-energy Processes [DE82-011999] p 124 N83-20406

- Desulfurization with transition metal catalysts [DE83-003062] p 126 N83-21071

- Low-temperature pyrolysis of coal to produce diesel-fuel blends [DE83-001637] p 126 N83-21076

- Propanol-plus as extender to diesel fuel [CSIR-ME-445] p 128 N83-21165

- Development of a thermodynamic properties correlation framework for the coal conversion industry, phase 2 [DE82-009866] p 148 N83-23190

COAL GASIFICATION

- Clean-up and processing of coal-derived gas for hydrogen applications p 87 A83-27336

- Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels [PB82-255167] p 96 N83-16459

- Rates and equilibria of devolatilization and trace element evolution in coal pyrolysis [PB82-260944] p 96 N83-16460

- Coal gasification for stationary gas-turbine applications [DE82-902135] p 97 N83-16553

- Mass balance results for the Princeton 1 underground coal gasification field test [DE82-005667] p 162 N83-16556

- Process engineering and mechanical design reports Volume 1 Preliminary design and assessment of a 50,000 BPD coal-to-methanol-to-gasoline plant [DE83-000848] p 97 N83-16559

- Characterization and supporting research for in-situ coal-gasification research and development project plan [DE83-000962] p 101 N83-16910

- Benefits to utility systems of coproduction of methanol and electricity [DE83-900279] p 101 N83-16913

- Identification and removal of the organic compounds in coal-conversion condensate waters [DE82-004825] p 8 N83-16955

- Chemical characterization of organic contaminants in groundwater near an underground coal gasification site [DE82-004822] p 8 N83-16956

- Catalytic effects of alkali metal salts in the gasification of coal char [DE82-000850] p 103 N83-17645

- Theoretical and experimental studies of fixed-bed coal gasification reactors [DE82-009515] p 104 N83-17655

- Effect of simulated medium-Btu coal gasifier atmospheres on the biaxial stress rupture behavior of four candidate coal gasifier alloys [DE82-008607] p 104 N83-17661

- Catalytic coal gasification An emerging technology for SNG [DE82-007596] p 104 N83-17676

- Development of standards and a cost model for coal agglomeration and related studies [DE82-011047] p 105 N83-17678

- Some 2 1/4Cr-1 Mo steels for coal-conversion pressure vessels [DE82-901349] p 105 N83-17707

- West Europe report Science and technology, no 133 [JPRS-82608] p 89 N83-17757

- First results, problems of French deep gasification program [DE82-008607] p 104 N83-17661

- Mass flow of char/coal in oxygen-blown entrained-bed gasifiers An assessment of instruments and methods of measurement [DE82-006988] p 107 N83-17852

- Fossil-energy program [DE82-007502] p 111 N83-18083

- Evaluation of gasification and gas-cleanup processes for use in molten-carbonate fuel-cell power plants [DE82-012244] p 167 N83-18084

- Site selection and characterization for an underground coal gasification test in Washington State Volume 2 Project details [DE82-010948] p 19 N83-18117

- Cleanup of groundwater contaminated by underground coal gasification [DE82-005824] p 19 N83-18118

- High resolution seismic survey of the Hanna, Wyoming underground coal gasification area [DE82-006887] p 112 N83-18137

- ASPEN technical reference manual [DE82-020201] p 112 N83-18325

- ASPEN technical reference manual [DE82-020200] p 112 N83-18326

- ASPEN system administrator manual [DE82-202199] p 112 N83-18327

- ASPEN system administrator manual [DE82-020198] p 113 N83-18328

- ASPEN user manual [DE82-020196] p 113 N83-18329

- Trace and minor element reactions in fluidized-bed combustion processes [PB82-240219] p 113 N83-18883

- Status of the Great Plains Coal Gasification Project, August 1982 [GAO/EMD-82-117] p 115 N83-19230

- Dynamic simulation of sulfur-removal systems [DE82-902074] p 119 N83-19865

- Formation/decomposition of condensable hydrocarbons during the gasification of coal [DE82-014493] p 119 N83-19866

- Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 2 User's manual for a computer program for 1-dimensional coal combustion or gasification (1-DICOG) [DE82-015610] p 119 N83-19868

- Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 3 User's manual for a computer program for 2-Dimensional Coal Gasification or Combustion (PCGC-2) [DE82-015611] p 119 N83-19869

- Transco medium-Btu coal gasification project Feasibility study, volume 1 p 119 N83-19872
[DE82-00959] p 119 N83-19872
- Transco medium-Btu coal gasification project Feasibility study, volume 2 p 119 N83-19873
[DE82-00959] p 119 N83-19873
- Transco medium-Btu coal gasification project Feasibility study, volume 3 p 120 N83-19874
[DE82-00959] p 120 N83-19874
- Materials for Coal Conversion and Utilization [DE82-013244] p 124 N83-20386
- Proceedings of the 1981 Symposium on Instrumentation and Control for Fossil-energy Processes [DE82-011999] p 124 N83-20406
- Fundamental research on Fischer-Tropsch synthesis [BMFT-FB-T-82-020] p 125 N83-21052
- Advanced gasification projects [DE83-003616] p 126 N83-21069
- Combustion research needs [PB83-107813] p 128 N83-21091
- Low-alloy steels for thick-walled pressure vessels [DE83-002547] p 128 N83-21127
- Energy inputs and outputs of fuel-alcohol production, appendices G and H Methanol from coal [DE83-000370] p 130 N83-21177
- Status of the Great Plains coal gasification project, August 1982 [PB83-115139] p 130 N83-21188
- Oxygen supply for coal gasification power stations (combined-cycle process) [BMFT-FB-T-82-018] p 131 N83-21505
- Power plant concepts using new coal conversion technologies [BMFT-FB-T-82-031] p 131 N83-21506
- Ceramic heat-exchanger applications study [DE83-003166] p 132 N83-21529
- Guide for the assessment of the availability of gasification-combined-cycle power plants [DE82-901905] p 77 N83-21579
- Review of hot-gas-desulfurization simulation models [DE82-016265] p 138 N83-22356
- Gas characterization from fluidized-bed coal gasification [DE82-012396] p 138 N83-22357
- Coal-gasification and tar-conversion reactions over calcium oxide [DE82-014635] p 139 N83-22358
- Enriched-air and oxygen gasification of Illinois No. 6 coal in a Texaco coal-gasification unit [DE82-903133] p 139 N83-22362
- Catalytic coal conversion support Use of laser flash-pyrolysis for structural analysis [DE82-014124] p 139 N83-22366
- The HFEM monitoring of coal gasification Rawlins, Wyoming [DE82-013801] p 142 N83-22466
- Boundary-layer control by means of strong injection [DE82-012547] p 142 N83-22568
- Evaluation of gasification and gas cleanup processes for use in molten carbonate fuel cell power plants [DE83-003821] p 183 N83-22787
- Underground Coal Gasification (UCG) gas to methanol and MTG-gasoline An economic and sensitivity study, task B [DE83-004320] p 146 N83-22821
- Dynamic simulation of Exxon's Catalytic Coal-Gasification process [DE82-021973] p 146 N83-22823
- Toxicology of coal gasification Chemical characterization p 148 N83-22960
- COAL LIQUEFACTION**
- Sasol The commercial experience An executive summary [DE82-011304] p 98 N83-16572
- Solvent-Refined-Coal (SRC) Process Coking of SRC-2 process streams Part 3 Effects of coal minerals on coking Part 4 Thermal properties of SRC-2 cokes and process streams [DE82-012369] p 104 N83-17657
- EDS coal-liquefaction process development Phase 5 EDS environmental program [DE82-005641] p 12 N83-17673
- Mechanisms and kinetics of coal hydrogenation [DE82-012338] p 105 N83-17677
- Some 2 1/4Cr-1 Mo steels for coal-conversion pressure vessels [DE82-901349] p 105 N83-17707
- Results of u-bend stress-corrosion-cracking specimen exposures in coal-liquefaction pilot plants [DE82-012889] p 105 N83-17708
- Extraction of coal with solvents in liquid and supercritical state under nonhydrogenating and hydrogenating conditions [BMFT-FB-T-82-177] p 109 N83-18032
- Pre-feasibility study for construction of a commercial coal hydrogenation plant [BMFT-FB-T-82-190] p 109 N83-18034
- Fossil-energy program [DE82-007502] p 111 N83-18083
- EDS coal-liquefaction process development Phase 5 EDS product quality [DE83-002226] p 117 N83-19827
- EDS coal-liquefaction process development, phase 5 [DE82-012444] p 118 N83-19862
- Chemistry and catalysis of coal liquefaction Catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels [DE82-012474] p 119 N83-19870
- Fundamental research on Fischer-Tropsch synthesis [BMFT-FB-T-82-020] p 125 N83-21052
- Catalytic hydrogenation of coal-derived liquids [DE83-003582] p 126 N83-21068
- Partial liquefaction of coal by flash hydrolysis [DE83-001145] p 126 N83-21077
- Catalytic coal liquefaction [DE83-001098] p 127 N83-21078
- Partial liquefaction of coal by flash hydrolysis, phase 4 [DE83-002167] p 127 N83-21085
- SRC-I project Baseline [DE83-000987] p 127 N83-21086
- Low-alloy steels for thick-walled pressure vessels [DE83-002547] p 128 N83-21127
- SRC-I solvent-refined-coal process Operation of the solvent-refined-coal pilot plant, Wilsonville, Alabama [DE82-009931] p 137 N83-22337
- Catalytic hydrogenation unit studies [DE83-003390] p 137 N83-22342
- Effects of several disposable catalysts on liquefaction of lignite [DE82-022188] p 138 N83-22351
- Exploratory study of coal conversion chemistry [DE82-013414] p 138 N83-22354
- Catalytic evaluation for H-coal [DE82-014457] p 138 N83-22355
- Coal-liquefaction-plant corrosion-coupon studies [DE82-007469] p 139 N83-22360
- Effect of liquefaction processing conditions on combustion characteristics of solvent-refined coal [DE82-903665] p 139 N83-22361
- Catalytic coal liquefaction [DE82-012562] p 139 N83-22363
- The relevance of coal geochemistry to coal utilization [DE82-007469] p 144 N83-22767
- Development of a thermodynamic properties correlation framework for the coal conversion industry, phase 2 [DE82-009866] p 148 N83-23190
- Alternative motor fuels p 148 N83-23214
- COAL UTILIZATION**
- Development and application of advanced diagnostics methods in fossil fuel combustion studies p 90 N83-20436
- Flames with impinging jets p 91 N83-21423
- An isothermal second-order Ringbom-Stirling engine computer program p 157 N83-27281
- Critique of conceptual design for removal of sodium from lignite by ion exchange [DE82-010789] p 95 N83-16439
- Advanced coal preparation [DE82-010502] p 97 N83-16561
- Coal as an option for power generation in US territories of the Pacific [DE82-009462] p 98 N83-16563
- H-Coal Pilot Plant Phase 2 Construction and Phase 3 Operation [DE82-005117] p 106 N83-17732
- Further development and evaluation of coal-water mixture technology [DE82-010518] p 106 N83-17736
- Solvent-Refined-Coal (SRC) process [DE82-010061] p 107 N83-17743
- Model simplification to examine the interrelationships between coal, gas and oil use [DE82-007816] p 110 N83-18061
- Fossil-energy program [DE82-007502] p 111 N83-18083
- Proceedings of the Workshop on Radioactivity Associated with Coal Gas [DE82-007880] p 18 N83-18100
- Leachate-treatment technique utilizing fly ash as low-cost sorbent [DE82-010501] p 111 N83-18101
- Estimating pollutant exposures from coal fired power plants in a rural region [DE82-008136] p 19 N83-18109
- Decision framework for technology choice Volume 1 A case study of one utility's coal-nuclear choice [DE82-902213] p 113 N83-18554
- Transport characteristics of alternate slurry fuels [DE82-013508] p 121 N83-19939
- Coal research [GPO-99-879] p 123 N83-20366
- Materials for Coal Conversion and Utilization [DE82-013244] p 124 N83-20386
- Engineering systems analysis of pressurized fluidized-combustion power systems [DE82-013390] p 127 N83-21083
- High-temperature turbine technology program Volume 5 Materials technology development [DE83-004330] p 181 N83-22607
- Energy resources in New Mexico Oil and gas, coal, electrical generation, uranium, and geothermal energy [DE83-900485] p 142 N83-22672
- Coal p 143 N83-22675
- Electrical generation p 143 N83-22676
- Parametric analysis of closed cycle magnetohydrodynamic (MHD) power plants [NASA-CR-165472] p 182 N83-22748
- COASTAL ECOLOGY**
- Gulf coast ecological inventory user's guide and information base [DE83-900406] p 28 N83-20455
- Examination of tidal flats Volume 3 Evaluation methodology [PB83-131805] p 148 N83-22949
- COASTS**
- Coastal zone wind energy Part 3 A procedure to determine the wind power potential of the coastal zone [DE82-014334] p 134 N83-21598
- COATINGS**
- Variation in the microstructure of electrodeposited black chrome solar coatings [DE81-030842] p 56 N83-16878
- Coatings for laser fusion [DE82-005698] p 165 N83-17330
- Evaluation of production version of the NASA improved inorganic-organic separator [NASA-TM-83018] p 166 N83-18022
- Development of metallization process, FSA project, cell and module formation research area [NASA-CR-169902] p 63 N83-19220
- Outdoor exposure tests of solar absorptive coatings [PB83-124560] p 84 N83-22840
- COAXIAL FLOW**
- Prediction of turbulent mixing in confined co-axial reacting jets p 91 N83-23191
- COBALT OXIDES**
- A mechanistic study of oxygen evolution on Li-doped Co₃O₄ --- by electrolysis p 85 N83-20586
- High temperature degradation in cobalt oxide selective absorber p 53 N83-28942
- COGENERATION**
- A method of evaluating and sizing solar cogeneration systems p 41 N83-23127
- Cogeneration using a thermionic combustor p 159 N83-27300
- Cogeneration in Municipalities Proceedings from Workshops for Local Governments and Municipal Utilities [DE82-905758] p 6 N83-16921
- Biomass cogeneration A business assessment [DE82-011773] p 101 N83-16928
- Cogeneration feasibility Otis Elevator Company and Polychrome Corporation [PB82-263526] p 7 N83-16942
- A preliminary study of environmental parameters associated with the feasibility of a polygeneration plant at Kennedy Space Center p 11 N83-17365
- External combustion steam injected gas turbine [DE82-019862] p 168 N83-19102
- Residential and commercial cogeneration systems assessment [PB82-240037] p 22 N83-19314
- District heating and more-efficient buildings [DE81-025437] p 26 N83-20379
- Bi-state solid-waste-to-energy project [DE83-004458] p 28 N83-20435
- Ceramic heat-exchanger applications study [DE83-003166] p 132 N83-21529
- Systems analysis of on-site integrated energy systems, phase 1 [DE83-000044] p 179 N83-21549
- Energy recovery and cogeneration from an existing municipal incinerator Phase 2A Final design [DE82-007911] p 179 N83-21577
- Cogeneration and small power production [GPO-99-484] p 35 N83-22752
- COHERENT LIGHT**
- Velocity measurements in an axisymmetric laminar flow using an optical technique of visualization in coherent light p 54 N83-29704

COKE

Solvent-Refined-Coal (SRC) Process Coking of SRC-2 process streams Part 3 Effects of coal minerals on coking Part 4 Thermal properties of SRC-2 cokes and process streams
[DE82-012369] p 104 N83-17657

COLD GAS

Heavy Gas Dispersal
[VKI-LS-1982-03] p 200 N83-19316
Identification of problem areas related to the dispersion of heavy gases p 200 N83-19318

COLD WATER

Increasing summer peak power with aquifer storage
p 191 A83-27313

COLD WELDING

Applications of ion beam technology
[NASA-CR-169797] p 88 N83-16493

COLORADO

Colorado geothermal resource assessment Shallow-hole temperature survey Intermediate-depth holes IGH no 1 and no 2, Depth test hole 44X-10
[DE83-002898] p 135 N83-21621

COLUMNS (PROCESS ENGINEERING)

Coal-liquefaction-plant fractionation-column corrosion-coupons studies
[DE82-007469] p 139 N83-22360

COMBINED CYCLE POWER GENERATION

Benefits to utility systems of coproduction of methanol and electricity
[DE83-900279] p 101 N83-16913
West Europe report Science and technology, no 133 [JPRS-82608] p 89 N83-17757
Decision framework for technology choice Volume 1 A case study of one utility's coal-nuclear choice
[DE82-902213] p 113 N83-18554
Oxygen supply for coal gasification power stations (combined cycle process)
[BMFT-FB-T-82-018] p 131 N83-21505
Guide for the assessment of the availability of gasification-combined-cycle power plants
[DE82-901905] p 77 N83-21579
Enriched-air and oxygen gasification of Illinois No 6 coal in a Texaco coal-gasification unit
[DE82-903133] p 139 N83-22362
High-temperature turbine technology program Volume 5 Materials technology development
[DE83-004330] p 181 N83-22607

COMBUSTIBLE FLOW

Premixed, turbulent combustion of a sudden-expansion flow
p 92 A83-23748
Using a global hydrogen-air combustion model in turbulent reacting flow calculations p 86 A83-24667
A study on the hydrogen-oxygen diffusion flame in high speed flow
p 93 A83-26199
Experimental investigation of shock initiated methane-combustion near a wall
p 93 A83-26200

COMBUSTION

Oil shale project run summary small retort run S-7
[DE82-004731] p 99 N83-16837
Characteristics of coal/light hydrocarbon slimes in spray combustion
[DE82-006294] p 102 N83-17639
Combustion of solvent-refined coal in a 100 HP firetube boiler
[DE82-007670] p 103 N83-17640
CaO interactions in the staged combustion of coal
[DE82-010299] p 103 N83-17641
Synthetic fuel effects in continuous combustion systems An experimental study of fuel nitrogen conversion in jet-stirred combustions
[DE82-002686] p 103 N83-17646
Fuel-composition and -vaporization effects on combustion-chamber deposits
[DE82-012576] p 104 N83-17670
Fossil energy program
[DE82-007496] p 111 N83-18082
Coal pyrolysis by hot solids from a fluidized-bed combustor
[DE83-003344] p 117 N83-19829
Synthetic-fuel aromaticity and staged combustion
[DE82-010302] p 118 N83-19858
EDS coal-liquefaction process development, phase 5
[DE82-012444] p 118 N83-19862
Controlled source audio-magnetotelluric (CSMAT) resistivity measurements for in-situ combustion
[DE82-016398] p 120 N83-19877
Materials for Coal Conversion and Utilization
[DE82-013244] p 124 N83-20386
Prospects for the development of non-noble metal catalysts for hydrogen-air fuel cells
[DE82-013875] p 176 N83-20422
Combustion research needs
[PB83-107813] p 128 N83-21091
Hall-Field limitations in MDH generators
[DE83-001149] p 177 N83-21246

A technology assessment of solar energy systems Direct combustion of wood and other biomass in industrial boilers
[DE83-000937] p 31 N83-21538

Electric home heating Substitution for oil and gas
[DE82-013762] p 133 N83-21581

Acid precipitation A critique of present knowledge and proposed action
[DE83-900303] p 34 N83-21650

Development of the utilization of combustible gas produced in existing sanitary landfills Effects of corrosion at the Mountain View, California landfill gas-recovery plant
[DE83-001576] p 145 N83-22769

COMBUSTION CHAMBERS

Flames with impinging jets
p 91 A83-21423
Radiation and smoke from the gas turbine combustor using heavy fuels
p 92 A83-23877
Catalyst durability evaluation for advanced gas turbine engines
[ASME PAPER 82-JPGG-GT-21] p 152 A83-25270
Cogeneration using a thermionic combustor
p 159 A83-27300

Fuel-composition and -vaporization effects on combustion-chamber deposits
[DE82-012576] p 104 N83-17670

Fossil-energy program
[DE82-007502] p 111 N83-18083

External combustion steam injected gas turbine
[DE82-019862] p 168 N83-19102
State-of-the-art combustion modification NOx control for stationary combustion equipment
[PB82-240201] p 23 N83-19340

Fuel property effects on diesel engine and gas turbine combustor performance
[AD-A120879] p 175 N83-20161
Survey of large combustors Alternative fuel burning capabilities of large boilers in 1979
[DE82-008386] p 127 N83-21079

Advanced atmospheric fluidized-bed combustion design Ultrahigh velocity
[DE83-004819] p 128 N83-21088

Combustion research needs
[PB83-107813] p 128 N83-21091

Centaur gas-turbine modification and development for solar-fossil hybrid operation
[DE83-900192] p 177 N83-21366

Power plant concepts using new coal conversion technologies
[BMFT-FB-T-82-031] p 131 N83-21506

CAESCAP A computer code for compressed-air energy-storage-plant cycle analysis
[DE83-003146] p 196 N83-21528

Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model
[DE83-004004] p 197 N83-22758

Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, Part 1 Turbomachinery design
[DE83-004005] p 197 N83-22759

Multi-fuel low-NOx burner development, phase 2
[PB83-126292] p 147 N83-22845

COMBUSTION CONTROL

A rationale for advances in the technology of IC engines
[DE82-005840] p 14 N83-17889

COMBUSTION EFFICIENCY

Catalyst durability evaluation for advanced gas turbine engines
[ASME PAPER 82-JPGG-GT-21] p 152 A83-25270
Possibilities of improving exhaust emissions and energy consumption in mixed hydrogen-gasoline operation
p 87 A83-27334

Investigation of methanol as a boiler fuel for electric-power generation
[DE82-905495] p 97 N83-16560

Rationale for advances in the technology of IC engines
[DE82-000264] p 14 N83-17886

Demonstration of modification of a gasoline spark-ignited engine to permit using ethanol as a fuel
[DE83-001384] p 114 N83-19101

Fuel property effects on diesel engine and gas turbine combustor performance
[AD-A120879] p 175 N83-20161

COMBUSTION PHYSICS

Investigation of slurry fuel performance for use in a ramjet propulsor
p 90 A83-21014
Trace and minor element reactions in fluidized-bed combustion processes
[PB82-240219] p 113 N83-18883

COMBUSTION PRODUCTS

Effect of molecular structure on incipient soot formation
p 90 A83-19847

Laser fluorescence measurements of the OH concentration in a combustion boundary layer
p 86 A83-24367

Design strategy for the combustion of coal-derived liquid fuels
[DE82-905496] p 95 N83-16444

Simulation of air-pollution propagation resulting from at-sea incineration wastes
[DE82-902297] p 10 N83-16979

Air traffic control Its effect on fuel conservation
p 12 N83-17464

CaO interactions in the staged combustion of coal
[DE82-010299] p 103 N83-17641

Continuously adjustable low-power gasifier burner/boiler system
[BMFT-FB-T-82-038] p 131 N83-21507

COMBUSTION STABILITY

Lightweight aircraft engines, the potential and problems for use of automotive fuels
p 141 N83-22446

COMMERCIAL AIRCRAFT

Symposium on Commercial Aviation Energy Conservation Strategies Papers and presentations
[AD-A107106] p 11 N83-17455

COMMERCIAL ENERGY

SOLERAS solar active cooling field test operations
p 48 A83-27239

An analysis of the cost/performance characteristics of passive solar materials and components
p 49 A83-27247

Geothermal energy Opportunities for California commerce, phase 1 report
[DE82-009121] p 110 N83-18066

Commercial building design and energy conservation A preliminary assessment
[DE82-008581] p 17 N83-18067

Federal energy conservation programs Perspectives from the public and private sectors Volume 2 Public hearing, July 14 and 15, 1981, Washington, D.C.
[PB82-238544] p 22 N83-19313

Technical documentation for the nonresidential-buildings energy-consumption survey, 1979 - 1980, building characteristics, energy end use and fuel oil tank data, public use data tapes Users' guide
[DE82-012523] p 24 N83-19957

Photovoltaic retrofit feasibility in the United States
[DE82-014508] p 69 N83-20393

Performance evaluation manual for submetered data collection
[DE82-011223] p 70 N83-20402

Introduction to the nonresidential buildings energy-consumption survey 1979-1980 building characteristics, energy end use and fuel oil tank data Public use data tapes, shoppers' guide
[DE82-012522] p 27 N83-20424

The application of DOE-2 in the predesign phase of commercial-building design
[DE82-014067] p 31 N83-21201

Energy-conserving and passive-solar construction details
[DE82-014467] p 76 N83-21569

District-heating system, La Grande, Oregon
[DE82-015102] p 32 N83-21593

COMPACTING

Porous metal hydride compacts - Preparation, properties and use
p 88 A83-27338

COMPARISON

Integration of hydrothermal-energy economics Related quantitative studies
[DE83-001407] p 178 N83-21544

Electric power from orbit A critique of a satellite power system
[DE83-002771] p 33 N83-21619

COMPLEX COMPOUNDS

Isolation of metallic complexes in shale oil and shale oil retort waters
[DE82-005931] p 98 N83-16835

Desulfurization with transition-metal catalysts
[DE82-013964] p 118 N83-19853

COMPLEX SYSTEMS

Application of multivariable systems theory; Symposium, Plymouth, England, October 26-28, 1982, Collected Papers
p 151 A83-23171

Systems and operations - Living with complexity and growth
p 86 A83-24357

COMPOSITE MATERIALS

Solar receiver cavity insulation evaluation
p 39 A83-22275

Recent advances in composite flywheel containment design technology
p 189 A83-27302

Twin disk composite flywheel
p 189 A83-27304

Applications of ion beam technology
[NASA-CR-169797] p 88 N83-16493

Fiberglass composite blades for the 2 MW Mod-1 wind turbine generator
p 170 N83-19241

- Engineering the Future for the Benefit of Mankind, volume 2
[PB82-225491] p 24 N83-19634
- Fatigue testing of low-cost fiberglass composite wind turbine blade materials
[NASA-CR-165566] p 181 N83-22746
- Study of vacuum systems for a heat engine/flywheel automotive propulsion system
[DE83-002284] p 198 N83-23244
- COMPOSITE STRUCTURES**
Design and evaluation of low cost blades for large wind driven generating systems p 170 N83-19244
- COMPRESSED AIR**
Factors affecting storage of compressed air in solution mined salt cavities p 191 A83-27311
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 3, part 1 Site Selection study
[DE82-001251] p 192 N83-16869
Hydraulic air compressor for ocean thermal energy conversion applications
[DE82-005198] p 163 N83-16880
Compressed-air energy storage Preliminary design and site development program in an aquifer Volume 3 Site-selection study, part 2
[DE83-001252] p 194 N83-18074
CAESCAP A computer code for compressed-air energy-storage-plant cycle analysis
[DE83-003146] p 196 N83-21528
Preliminary design study of compressed-air energy storage in a salt dome Volume 6 CAES plant design
[DE82-014355] p 196 N83-21580
Analytical modeling of a hydraulically-compensated compressed-air energy-storage system
[DE83-005708] p 197 N83-21640
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model
[DE83-004004] p 197 N83-22758
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, Part 1 Turbomachinery design
[DE83-004005] p 197 N83-22759
Issues affecting storage of compressed air in solution-mined salt cavities
[DE83-002017] p 197 N83-22804
Aquifer compressed-air field experiment at Pittsfield, Illinois
[DE83-002057] p 198 N83-22805
Underground energy-storage program overview
[DE83-002059] p 198 N83-22806
Geotechnical basis for underground energy storage in hard rock
[DE82-903307] p 198 N83-22836
- COMPRESSING**
Energy from humid air
[DE82-017121] p 180 N83-21601
- COMPRESSOR BLADES**
Turbine engine fuel conservation by fan and compressor profile control p 12 N83-17467
- COMPRESSOR ROTORS**
18.1 pressure ratio axial/centrifugal compressor demonstration program p 161 A83-29013
- COMPRESSORS**
Hydraulic air compressor for ocean thermal energy conversion applications
[DE82-005198] p 163 N83-16880
Open-cycle vapor compression heat pump
[PB82-262569] p 8 N83-16947
Solar/gas Brayton/Rankine cycle heat pump assessment
[PB83-102319] p 67 N83-19963
Status of DOE small hydropower research and development projects
[DE83-001353] p 125 N83-20434
CAESCAP A computer code for compressed-air energy-storage-plant cycle analysis
[DE83-003146] p 196 N83-21528
- COMPUTATIONAL FLUID DYNAMICS**
Prediction of turbulent mixing in confined co-axial reacting jets p 91 A83-23191
Numerical calculation of the heat transfer by natural convection in a cubical enclosure p 42 A83-23212
Finite element analysis of mixed convection applied to the storage of solar energy p 42 A83-23219
Using a global hydrogen-air combustion model in turbulent reacting flow calculations p 86 A83-24667
- COMPUTER AIDED DESIGN**
A system of criteria for evaluating the energy efficiency of an engine at the state of technical proposals p 1 A83-23437
Systems and operations - Living with complexity and growth p 86 A83-24357
An isothermal second-order Ringbom-Stirling engine computer program p 157 A83-27281
- ASPEN technical reference manual
[DE82-020201] p 112 N83-18325
ASPEN technical reference manual
[DE82-020200] p 112 N83-18326
ASPEN system administrator manual
[DE82-202199] p 112 N83-18327
ASPEN system administrator manual
[DE82-020198] p 113 N83-18328
ASPEN user manual
[DE82-020196] p 113 N83-18329
The application of DOE-2 in the predesign phase of commercial-building design
[DE82-014067] p 31 N83-21201
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model
[DE83-004004] p 197 N83-22758
- COMPUTER GRAPHICS**
Cartographic evaluation of environmental-management strategies
[DE82-009828] p 35 N83-22702
- COMPUTER PROGRAM INTEGRITY**
Theory of the computer code RET 1 for the calculation of space-time dependent temperature and composition properties of metal hydride hydrogen storage beds p 88 A83-27337
- COMPUTER PROGRAMMING**
Simulation of wind-speed time series for wind-energy conversion analysis
[DE83-000043] p 165 N83-17026
Transportation network models for energy supply analysis Volume 3 Transportation network model user's guide and documentation
[DE82-903079] p 187 N83-20400
- COMPUTER PROGRAMS**
User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 2 Appendices
[DE82-022511] p 99 N83-16866
Energy audits at 48 hospitals
[DE82-002814] p 5 N83-16884
Modeling energy/economy interactions for conservation and renewable energy-policy analysis
[DE82-009159] p 7 N83-16926
Computerized engine and airplane performance monitoring programs p 12 N83-17465
A practical economic criterion for fuel conservation p 12 N83-17468
Study based on ammonia/water solutions of a district heating transport system
[BMFT-FB-T-82-188] p 186 N83-18033
Model simplification to examine the interrelationships between coal, gas and oil use
[DE82-007816] p 110 N83-18061
Evaluation of the mathematical and economic basis for conversion processes in the LEAP energy-economy model
[DE83-001706] p 167 N83-18079
ASPEN technical reference manual
[DE82-020201] p 112 N83-18325
Energy and life-cycle cost analysis of a six-story office building
[DE82-004840] p 20 N83-18963
Free yaw performance of the Mod-0 large horizontal axis 100 kW wind turbine p 170 N83-19235
WTS-4 system verification unit for wind/hydroelectric integration study p 173 N83-19267
Open-cycle systems performance analysis programming guide
[DE82-005696] p 174 N83-19282
Overview of existing residential energy-efficiency rating systems and measuring tools
[DE83-003148] p 20 N83-19289
Development and implementation of dynamic methodologies for evaluating energy conservation strategies
[PB82-240763] p 21 N83-19304
Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 2 User's manual for a computer program for 1-dimensional coal combustion or gasification (1-DICOG)
[DE82-015610] p 119 N83-19868
Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 3 User's manual for a computer program for 2-Dimensional Coal Gasification or Combustion (PCGC-2)
[DE82-015611] p 119 N83-19869
Solar/gas Brayton/Rankine cycle heat pump assessment
[PB83-102319] p 67 N83-19963
Modeling water supply for the energy sector p 25 N83-20336
- PLTSYM A FORTRAN computer system to plot Canadian symbol location maps for hydrogeochemical and stream-sediment reconnaissance data
[DE83-000764] p 123 N83-20337
Transportation network models for energy supply analysis Volume 3 Transportation network model user's guide and documentation
[DE82-903079] p 187 N83-20400
On-site fuel cell power plant technology development program
[PB83-102335] p 176 N83-20437
Shading analysis of a photovoltaic-cell string illuminated by a parabolic-trough concentrator
[DE83-002646] p 74 N83-21537
Integration of hydrothermal-energy economics Related quantitative studies
[DE83-001407] p 178 N83-21544
Program listing for air-to-air heat pump steady-state Computer-Simulation Mode (CSM)
[DE83-002549] p 32 N83-21559
Electric-utility value determination for wind energy Volume 2 A user's guide
[DE82-010926] p 134 N83-21596
Program listing for heat-pump Seasonal-Performance Model (SPM)
[DE83-002436] p 33 N83-21612
Design approaches for solar industrial process-heat systems Nontracking and line-focus collector technologies
[DE83-003339] p 79 N83-21620
Analytical modeling of a hydraulically-compensated compressed-air energy-storage system
[DE83-005708] p 197 N83-21640
User's manual for HDR3 computer code
[DE83-003993] p 136 N83-21828
Computer-aided industrial process design The ASPEN project
[DE82-014469] p 181 N83-22484
Production costing of an Advanced/Innovative Wind Energy Concept (AIWEC) Extension of the SAMICS methodology
[DE83-003085] p 182 N83-22783
Development of an advanced solar augmented water heater (for single family home applications)
[PB83-119610] p 84 N83-22842
- COMPUTER SYSTEMS PROGRAMS**
ASPEN system administrator manual
[DE82-202199] p 112 N83-18327
ASPEN system administrator manual
[DE82-020198] p 113 N83-18328
ASPEN user manual
[DE82-020196] p 113 N83-18329
- COMPUTERIZED SIMULATION**
f-Chart - Predictions and measurements ... of solar heating systems p 42 A83-23880
Ground contamination by fuel jettisoned from aircraft in flight p 1 A83-24041
Using a global hydrogen-air combustion model in turbulent reacting flow calculations p 86 A83-24667
A heat pipe simulation technique for spacecraft thermal testing under variable orientation
[SAE PAPER 820860] p 185 A83-25760
AQUASTOR - A computer model for cost analysis of aquifer thermal energy storage coupled with district heating or cooling systems p 191 A83-27314
Modeling and evaluation of designs for solid hydrogen storage beds p 87 A83-27333
Computer simulation of the optical behaviour of amorphous silicon solar cells p 51 A83-27979
Control design and performance analysis of a 6 MW wind turbine-generator p 162 A83-28897
Security assessment of power systems including energy storage and with the integration of wind energy Volume 1 Digital transient simulation effort consulting agreement number 1
[DE82-021063] p 164 N83-16915
Simulation of air-pollution propagation resulting from at-sea incineration wastes
[DE82-902297] p 10 N83-16979
WTS-4 system verification unit for wind/hydroelectric integration study p 173 N83-19267
Development and implementation of dynamic methodologies for evaluating energy conservation strategies
[PB82-240763] p 21 N83-19304
Development and implementation of dynamic methodologies for evaluating energy conservation strategies Executive summary
[PB82-240771] p 21 N83-19305
Shading analysis of a photovoltaic-cell string illuminated by a parabolic-trough concentrator
[DE83-002646] p 74 N83-21537
Energy use test facility CAC-DOE solar air heater test report
[DE83-900162] p 75 N83-21546

Performance characteristics and design criteria for the thermic diode, a passive thermosiphon solar heating system
[DE82-012455] p 78 N83-21604

CONCENTRATION (COMPOSITION)

Dissolved methane concentrations in the southeast Bering Sea, 1980 and 1981
[PB83-112433] p 29 N83-20525

CONCENTRATORS

Area utilization efficiency of a sloping heliostat system for solar concentration p 39 N83-22618
EA study of solar concentrator panels with fluorescent compounds p 40 N83-22911
Simplified calculational procedure for determining the amount of intercepted sunlight in an imaging solar concentrator p 43 N83-23884
Comparison of advanced thermal and electrical storage for parabolic dish solar thermal power systems p 47 N83-27232

Cassegrainian concentrator solar array exploratory development module p 49 N83-27250
Design of large, low-concentration-ratio solar arrays for low earth orbit applications p 49 N83-27254
Concentrator systems in photovoltaic conversion - Assessment and perspectives --- French thesis p 53 N83-28653

Solar furnace for flux gage calibration and thermal-effects testing p 62 N83-18062

Optimization of dish solar collectors with and without secondary concentrators p 64 N83-19224
Design rules for a 100X maximum efficiency GaAs concentrator solar cell for space applications
[NASA-CR-170005] p 67 N83-20362

Airport solar photovoltaic concentrator
[DE83-003137] p 68 N83-20384
Silicon concentrator cell-assembly development
[DE83-001683] p 84 N83-22822

CONDENSERS

Optimal heat pumps for solar-assisted heat-pump systems
[DE82-004798] p 55 N83-16688

CONES

Some experiments on Yaw stability of wind turbines with various coning angles
[NASA-CR-168108] p 181 N83-22740

CONFERENCES

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Advanced coal preparation
[DE82-010502] p 97 N83-16561
Cogeneration in Municipalities Proceedings from Workshops for Local Governments and Municipal Utilities
[DE82-905758] p 6 N83-16921

Symposium on Commercial Aviation Energy Conservation Strategies Papers and presentations
[AD-A107106] p 11 N83-17455

Workshop on the Status of Industrial Organic Electrochemistry, summary
[DE82-901982] p 103 N83-17647
The Second Conference on the Environmental Chemistry of Hydrazine Fuels
[AD-A121324] p 13 N83-17731

The New England Energy Congress Project
[DE82-005521] p 16 N83-18041

Proceedings of the Fifth Annual Geothermal Conference and Workshop
[DE82-901295] p 110 N83-18052

Proceedings of the Workshop on Radioactivity Associated with Coal Gas
[DE82-007880] p 18 N83-18100

Large Horizontal-Axis Wind Turbines
[NASA-CP-2230] p 169 N83-19231

Oil and Gas Supply Modeling
[PB82-234139] p 117 N83-19310

Short-Term Bioassays in the Analysis of Complex Environmental Mixtures 2 p 23 N83-19420

Diesel Emissions Symposium Proceedings
[PB82-244013] p 23 N83-19462

Energy-efficient technology Advancing US competitiveness and productivity
[GPO-98-637] p 25 N83-20371

Solar for industry
[DE83-003301] p 68 N83-20381

Proceedings of the 1981 Symposium on Instrumentation and Control for Fossil-energy Processes
[DE82-011999] p 124 N83-20406

Workshop on the Federal Role in the Commercialization of Large Scale Windmill Technology (summary and papers)
[PB83-105593] p 28 N83-20438

Fourth ESTEC spacecraft power-conditioning seminar
[ESA-SP-186] p 176 N83-21006

Workshop on the Federal Role in Syntuels Development
[PB83-102236] p 30 N83-21187

Geothermal Direct Heat Program Roundup, volume 1
[DE82-019912] p 135 N83-21628

Aviation Gasolines and Future Alternatives
[NASA-CP-2267] p 140 N83-22442

Industry/Government Forum on Recent Policy and Budget Changes in the DOE Solar-Thermal Program
[DE82-012511] p 36 N83-22801

International Energy Workshop, 1981
[DE82-021183] p 36 N83-22816

Methane Hydrates Workshop Technical Proceedings
[DE83-000580] p 147 N83-22825

Geothermal Energy, Opportunities for California Business A two-day Conference on Direct Utilization of Geothermal Energy
[DE82-012553] p 147 N83-22826

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[DE82-008853] p 198 N83-22837

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[CSIR-S-313-VOL-2] p 37 N83-23212

CONFINEMENT

Flame acceleration mechanisms under conditions of partial confinement
[PB83-109884] p 120 N83-19881

CONGRESSIONAL REPORTS

Critical need for energy research and development The role of the Midwest Research Laboratories
[GPO-11-308] p 169 N83-19229

The socioeconomic impacts of synthetic fuels
[GPO-98-702] p 24 N83-19923

US electric power system reliability
[GPO-99-628] p 24 N83-20002

Diesel technology
[GPO-99-748] p 25 N83-20151

Coal research
[GPO-99-879] p 123 N83-20366

Renewable energy in the eighties Needs for further R and D
[GPO-99-663] p 25 N83-20367

US solar and conservation technologies in international markets
[GPO-99-627] p 25 N83-20369

Building energy research
[GPO-11-221] p 25 N83-20370

Energy-efficient technology Advancing US competitiveness and productivity
[GPO-98-637] p 25 N83-20371

Fiscal year 1983 Department of Energy budget review
[GPO-98-550] p 175 N83-20372

Cogeneration and small power production
[GPO-99-464] p 35 N83-22752

World petroleum outlook, 1982
[GPO-95-066] p 35 N83-22753

CONSERVATION

Modeling water supply for the energy sector
[GPO-99-663] p 25 N83-20367

CONSTRAINTS

Fuel conservation and economy constraints
[GPO-99-663] p 34 N83-22179

CONSTRUCTION

General review of wind engineering problems
[GPO-99-663] p 114 N83-18944

SRC-I project Baseline
[DE83-000987] p 127 N83-21086

Design and fabrication of a prototype system for photovoltaic residences in the southwest
[DE83-003935] p 72 N83-21200

CONSTRUCTION INDUSTRY

Study of domestic social and economic impacts of Ocean Thermal Energy Conversion (OTEC) commercial development Volume 2 Industry profiles
[DE83-001112] p 21 N83-19292

Passive-Solar Commercial Buildings Program, 1980 - 1982
[DE82-012472] p 72 N83-21202

CONSTRUCTION MATERIALS

Investigation of latent heat storage materials in the medium and high temperature range
[PB82-259896] p 193 N83-16933

Solar-energy treatment of ceramic tiles
[DE83-000147] p 65 N83-19296

CONTACT RESISTANCE

Metallurgical aspects of interstrand resistance --- superconducting magnets
[DE82-005504] p 186 N83-17342

CONTAINMENT

Recent advances in composite flywheel containment design technology p 189 N83-27302

CONTAMINANTS

Chemical characterization of organic contaminants in groundwater near an underground coal gasification site
[DE82-004822] p 8 N83-16956

Geotoxic materials in the surface environment
[DE82-005855] p 23 N83-19333

CONTROL

Design and fabrication of a prototype system for photovoltaic residences in the Northeast
[DE82-022210] p 55 N83-16872

Turbine engine fuel conservation by fan and compressor profile control p 12 N83-17467

Design and fabrication of a prototype system for photovoltaic residences in the southwest
[DE83-003935] p 72 N83-21200

The investigation of passive blade cyclic pitch variation using an automatic yaw control system
[DE83-000651] p 178 N83-21548

Design approaches for solar industrial process-heat systems Nontracking and line-focus collector technologies
[DE83-003339] p 79 N83-21620

CONTROL EQUIPMENT

Regulation of a system with variable structure --- for boilers of solar powered central receivers p 43 N83-24761

CONTROL STABILITY

Control design and performance analysis of a 6 MW wind turbine-generator p 162 N83-29897

CONTROL THEORY

Application of multivariable systems theory, Symposium, Plymouth, England, October 26-28, 1982, Collected Papers p 151 N83-23171

CONTROLLED FUSION

Survey of nuclear fusion technology A prospect analysis of Tokamak fusion research
[DE82-700131] p 168 N83-18451

CONVECTIVE HEAT TRANSFER

Finite element analysis of mixed convection applied to the storage of solar energy p 42 N83-23219

Convective losses from cavity solar receivers - Comparisons between analytical predictions and experimental results p 42 N83-23881

Convective heat losses from flat-plate solar collectors in turbulent winds p 43 N83-23883

COOLANTS

Back-to-back test for determining the pumping losses in a Stirling cycle machine p 158 N83-27290

COOLING

On-site production of electrolytic hydrogen for generator cooling p 86 N83-27209

Efficient daylighting in thermally controlled environments
[DE82-003045] p 6 N83-16885

Hall-Field limitations in MDH generators
[DE83-001149] p 177 N83-21246

Program listing for air-to-air heat pump steady-state Computer-Simulation Mode (CSM)
[DE83-002549] p 32 N83-21559

Additional testing of the passive heat-pipe-cooled solar photovoltaic receiver
[DE-83-004474] p 78 N83-21615

Energy-transmission-system heat losses
[DE83-003628] p 187 N83-22786

Assessment of the need for dry cooling, 1981 update
[DE82-009395] p 146 N83-22803

Performance criteria for solar heating and cooling systems in residential buildings
[PB83-122663] p 85 N83-22843

COOLING SYSTEMS

SOLERAS solar active cooling field test operations
[GPO-99-663] p 48 N83-27239

Use of parabolic trough collectors for residential/light commercial solar cooling systems p 48 N83-27245

A method for producing heat pipes for cooling semiconductor photovoltaic cells and the heat pipe characteristics p 52 N83-28366

Performance simulation of the JPL solar-powered distiller Part 1 Quasi-steady-state conditions --- for cooling microwave equipment p 66 N83-19781

Vertical sampling flights in support of the 1981 ASCOT cooling tower experiments Field effort and data
[DE82-014269] p 135 N83-21661

SUBJECT INDEX

- Solar-assisted water-source heat pump
[DE82-013981] p 81 N83-22567
- COOPERATION**
Meeting the challenge of climate
[PB83-106443] p 29 N83-20511
- COPOLYMERS**
Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery
[DE82-008705] p 140 N83-22436
- COPPER**
Study of the electrowinning of copper using a fluidized-bed electrochemical reactor
[DE83-004854] p 181 N83-22404
- COPPER CHLORIDES**
Investigation of intercalated compounds for photoelectrochemical energy storage
[DE83-000543] p 192 N83-16899
- COPPER OXIDES**
Experimental and theoretical studies of Cu₂O solar cells
p 40 N83-22907
Properties of oxidized copper surfaces for solar applications I
p 54 N83-29512
Properties of oxidized copper surfaces for solar applications II
p 54 N83-29513
- COPPER SULFIDES**
Investigation of intercalated compounds for photoelectrochemical energy storage
[DE83-000543] p 192 N83-16899
- CORE SAMPLING**
First results, problems of French deep gasification program
p 107 N83-17765
- CORN**
Microorganisms for fermentation of crop residues
[DE82-006912] p 102 N83-17051
Technical/commercial feasibility study of the production of fuel-grade ethanol for corn 100-million gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000772] p 129 N83-21173
Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana Volume 1 Executive summary
[DE83-000777] p 132 N83-21531
Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000776] p 132 N83-21532
Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000775] p 132 N83-21533
Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana Volume 5 Appendices
[DE83-000773] p 133 N83-21534
Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000774] p 133 N83-21535
- CORROSION**
Corrosion of 310 stainless steel in H₂-H₂O-H₂S gas mixtures Studies at constant temperature and fixed oxygen potential
p 90 N83-20265
Development of advanced batteries for utility application
[DE82-906459] p 193 N83-16918
Sulfuric acid/water chemical heat pump/chemical energy storage, phases 1 and 2, phases 3 and 4
[DE83-001255] p 195 N83-20380
Coal-liqefaction-plant fractionation-column corrosion-coupon studies
[DE82-007469] p 139 N83-22360
Boundary-layer control by means of strong injection
[DE82-012547] p 142 N83-22568
Development of the utilization of combustible gas produced in existing sanitary landfills Effects of corrosion at the Mountain View, California landfill gas-recovery plant
[DE83-001576] p 145 N83-22769
- CORROSION PREVENTION**
Heat pipes containing alkali metal working fluid
[NASA-CASE-LEW-12253-1] p 186 N83-19596
- CORROSION RESISTANCE**
High-temperature geothermal cableheads
[DE82-005864] p 117 N83-19302
Thermal-convective-loop correction tests of 316SS and IN800 in molten nitrate salts
[DE82-012313] p 66 N83-19898
- CORROSION TEST LOOPS**
Thermal-convective-loop study of the corrosion of Fe-Ni-Cr alloys by molten NaNO₂/sub 3-KNO₃/sub 3
[DE83-004228] p 80 N83-22407

COST ANALYSIS

- Size effects in DAWT innovative wind energy system design
[ASME PAPER 82-WA/SOL-20] p 153 A83-25688
A viable process for producing hydrogen synfuel using nuclear fusion heat
p 87 A83-27210
Is LH2 the high cost option for aircraft fuel
p 87 A83-27215
An analysis of the cost/performance characteristics of passive solar materials and components
p 49 A83-27247
AQUASTOR - A computer model for cost analysis of aquifer thermal energy storage coupled with district heating or cooling systems
p 191 A83-27314
Cost and performance of thermal storage concepts in solar thermal systems, Phase 2-liquid metal receivers
p 51 A83-27316
Critique of conceptual design for removal of sodium from lignite by ion exchange
[DE82-010789] p 95 N83-16439
User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 1 Main text
[DE82-022512] p 99 N83-16865
User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 2 Appendices
[DE82-022511] p 99 N83-16866
Comparative values of advanced space solar cells
[NASA-TM-84951] p 60 N83-18023
The energy transition and the macroeconomy A framework for policy analysis
[DE82-007839] p 16 N83-18039
Conceptual design study Standard Floating Nuclear Power Plant on inshore site and Modified Floating Nuclear Power plant on upriver site
[DE82-007916] p 174 N83-19595
Present and potential use of micro-hydroelectric schemes in remote locations
[DE82-904687] p 26 N83-20411
Design and fabrication of a prototype system for photovoltaic residences in the southwest
[DE83-003935] p 72 N83-21200
Real time sensors in geothermal fluids, their costs and benefits
[DE82-014857] p 130 N83-21328
Liquefaction behavior of a Canadian subbituminous coal in companship with several US lignites and subbituminous coals
[DE82-021976] p 146 N83-22824
- COST EFFECTIVENESS**
Multiple and variable speed electrical generator systems for large wind turbines
p 170 N83-19236
Long-term energy capture and the effects of optimizing wind turbine operating strategies
p 171 N83-19248
An overview of large wind turbine tests by electric utilities
p 172 N83-19265
Definition of cost-effective river-turbine designs
[DE82-010972] p 175 N83-20413
Potential benefits of R and D directed toward increasing the cost-effectiveness of energy use
[DE83-013435] p 27 N83-20423
Utilization of secondary energy resources at Magnitogorsk Metallurgical Combine
[BLL-M-26856-(5828 4)] p 131 N83-21502
Acid precipitation A critique of present knowledge and proposed action
[DE83-900303] p 34 N83-21650
- COST ESTIMATES**
Can industry afford solar energy
p 44 A83-25144
Analysis of energy use at US institutional buildings
[DE82-004670] p 6 N83-16886
Development of standards and a cost model for coal agglomeration and related studies
[DE82-011047] p 105 N83-17678
Cost of heat from a seasonal source
[DE82-006026] p 194 N83-18045
Mod-2 wind turbine project assessment and cluster test plans
p 172 N83-19262
Conceptual design of the 6 MW Mod-5A wind turbine generator
p 173 N83-19271
Conceptual design of the 7 megawatt Mod-5B wind turbine generator
p 173 N83-19272
Economic feasibility of solar thermal industrial applications and selected case studies
[DE82-009503] p 66 N83-19303
Acid rain mitigation study Volume 2 FGD cost estimates, appendices
[PB83-117366] p 29 N83-20469
Steam generation in line-focus solar collectors A comparative assessment of thermal performance, operating stability and cost issues
[DE82-014531] p 76 N83-21568

CRUDE OIL

- Production costing of an Advanced/Innovative Wind Energy Concept (AIWEC) Extension of the SAMICS methodology
[DE83-003085] p 182 N83-22783
- COST INCENTIVES**
Game-theory approach to consumer incentives for solar energy
[DE82-004501] p 56 N83-16882
- COST REDUCTION**
Cassegrainian concentrator solar array exploratory development module
p 49 A83-27250
- COSTS**
Costs to reduce sulfur dioxide emissions
[DE82-013309] p 28 N83-20451
- COUPLING**
Simulation and design of passive processes
[DE82-016647] p 70 N83-20401
- COVERINGS**
Heat loss coefficients and effective tau-alpha products for flat-plate collectors with diathermanous covers
p 53 A83-28939
- CRACK PROPAGATION**
Low-alloy steels for thick-walled pressure vessels
[DE83-002547] p 128 N83-21127
Thermal fatigue tests of Solar One receiver-tube weldments
[DE82-012520] p 81 N83-22599
- CRACKS**
Metallurgical investigation of disc cracking in the LP-2 turbine at a nuclear power station
[DE82-906428] p 162 N83-16515
- CREEP PROPERTIES**
Receiver subsystem analysis report (RADL Item 4-1) The 10-MWe solar thermal central-receiver pilot plant Solar-facilities design integration
[DE83-001638] p 65 N83-19295
- CREEP STRENGTH**
Evaluation of deterioration due to hot creep in chrome-molybdenum ferritic steels used in thermal power stations
[BLL-CE-TRANS-7669-(9022 09)] p 162 N83-16470
Physical properties data compilations relevant to energy storage Part 5 Mechanical properties data on alloys for use in flywheels
[PB82-232919] p 194 N83-18904
- CRITERIA**
Evaluation of solar reflective surfaces for dish concentrators
p 48 A83-27237
- CROP GROWTH**
The utilization of emergent aquatic plants for biomass-energy-systems development
[DE82-009174] p 124 N83-20395
Energy from biomass Land analysis and evaluation of supply models
[DE83-003333] p 132 N83-21524
- CRUDE OIL**
The effect of the melt heat treatment time on the properties of lithium lubricants with additives
p 94 A83-26921
Effects of petroleum on selected uniform substrates
A feasibility study
[PB82-255084] p 10 N83-16985
The importance of satisfactory positioning, diving and mapping systems, suitable for exploration and transportation in ice-covered sea areas
[FOA-B-60003-M7] p 107 N83-17999
Model simplification to examine the interrelationships between coal, gas and oil use
[DE82-007816] p 110 N83-18061
Project DEEP STEAM
[DE82-010945] p 111 N83-18078
Perspectives in Geology Invited papers presented at a symposium in observance of the 75th anniversary of the Illinois State Geological Survey
[PB-255589] p 112 N83-18138
US petroleum exploration Likely targets 1980 - 2000
p 112 N83-18141
Experience in testing of a solution mined storage cavern
[DE82-011013] p 113 N83-18464
Petroleum contamination Quantification and passive tagging in organisms and sediments
[PB82-254087] p 113 N83-18880
Evaluation of the maintenance effect on fugitive emissions from refineries in the south coast air quality management district
[PB82-239260] p 23 N83-19356
International energy indicators
[DE82-012504] p 26 N83-20405
World oil
[DE82-906440] p 27 N83-20433
Combustion of oil on water An experimental program
[DE82-014598] p 127 N83-21084
A review of world hydrocarbon resource assessments
[DE83-900732] p 131 N83-21499
Oil and gas
p 34 N83-22674

- World petroleum outlook, 1982
[GPO-95-066] p 35 N83-22753
- International Energy Workshop, 1981
[DE82-021183] p 36 N83-22816
- CRUISING FLIGHT**
Fuel conservation techniques in jet transport aircraft operations p 12 N83-17463
- CRUSHING**
Ultrasonically enhanced size reduction of coal
[DE82-008679] p 113 N83-18416
- CRYOGENIC COOLING**
The effect of parasitic refrigeration on the efficiency of magnetic liquefiers p 155 A83-27212
- CRYSTAL GROWTH**
Polycrystalline solar cell/substrate growth by integrated vacuum evaporation
[DE82-017203] p 58 N83-16917
Large area silicon sheet by EFG
[NASA-CR-169920] p 63 N83-19219
Advanced silicon-sheet-growth techniques
[DE82-017088] p 84 N83-22831
- CRYSTAL STRUCTURE**
The structure of 110 tilt boundaries in large area solar silicon
[NASA-CR-170204] p 81 N83-22744
- CULTURE TECHNIQUES**
Microorganisms for fermentation of crop residues
[DE82-006912] p 102 N83-17051
- CURRENT CONVERTERS (AC TO DC)**
Application of microprocessor-based controls in an ac/dc power conversion system p 188 A83-27151
- CURRENT DENSITY**
Simple porous electrode models for molten carbonate fuel cells p 149 A83-18991
High efficiency $p/+/-n-n/+/-$ back-surface field silicon solar cells with very large short-circuit current densities p 41 A83-22913
Open-circuit voltages across two junctions in $n/+/-p-p/+/-$ solar cells under high illumination levels p 51 A83-27976
Half-field limitations in MDH generators
[DE83-001149] p 177 N83-21246
Photovoltaic cell and module status assessment Volume 1 Technology overview
[DE83-900567] p 82 N83-22791
- CURRENT DISTRIBUTION**
Cross-sectional current distribution in coal fired diagonal conducting wall MHD generator p 151 A83-23130
MHD channel electrical boundary-layer theory and applications p 151 A83-23131
- CURVES (GEOMETRY)**
Photovoltaic 1-5 curve measurement techniques
[DE83-000447] p 80 N83-22534
- CYLINDRICAL TANKS**
Performance of a cylindrical phase-change thermal energy storage unit p 191 A83-28969

D

- DAMPING**
The investigation of passive blade cyclic pitch variation using an automatic yaw control system
[DE83-000651] p 178 N83-21548
- DATA ACQUISITION**
Innovative photovoltaic application for residences experiment
[DE83-000399] p 57 N83-16898
Meteorological field measurements at potential and actual wind-turbine sites p 174 N83-19398
Bartlesville Energy Technology Center enhanced oil recovery project data base
[DE82-012568] p 123 N83-20333
Intermediate photovoltaic system application experiment operational performance Volume 5 Beverly High School, Beverly Massachusetts, Executive summary
[DE82-014711] p 76 N83-21563
Intermediate photovoltaic system application experiment operational executive summary Volume 7 Newman Power Station, El Paso, Texas
[DE82-014647] p 76 N83-21564
Intermediate photovoltaic system application experiment operational performance executive summary Volume 7 Lovington Square Shopping Center, Lovington, New Mexico
[DE82-014649] p 76 N83-21566
Central receiver test facility assembly building
[DE82-010853] p 76 N83-21567
Design approaches for solar industrial process-heat systems Nontracking and line-focus collector technologies
[DE83-003339] p 79 N83-21620
SRC-I solvent-refined-coal process Operation of the solvent-refined-coal pilot plant, Wilsonville, Alabama
[DE82-009931] p 137 N83-22337

- methods for evaluating the DOE
Appropriate-Technology Program A review and compilation of evaluation methods
[DE83-003306] p 145 N83-22781
- DATA BASE MANAGEMENT SYSTEMS**
Statistical database management for ecosystem-effects analysis
[DE82-005199] p 18 N83-18104
- DATA BASES**
Energy audits at 48 hospitals
[DE82-002814] p 5 N83-16884
Analysis of energy use at US institutional buildings
[DE82-004670] p 6 N83-16886
Development of statistical databases for toxicological studies
[DE82-005196] p 10 N83-17067
Analytical and policy issues in energy economics Uses of the FRS data base
[DE82-004258] p 16 N83-18051
Energy-data validation An overview and some concepts
[DE82-020901] p 27 N83-20431
On-site fuel cell field test support program
[PB83-121723] p 28 N83-20439
Energy data base guide to abstracting and indexing
[DE82-005748] p 200 N83-20821
Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703
- DATA MANAGEMENT**
Environmental data for sites in the National Solar Data Network
[DE82-007055] p 64 N83-19280
- DATA PROCESSING**
Simulation of wind-speed time series for wind-energy conversion analysis
[DE83-000043] p 165 N83-17026
- DECISION MAKING**
An Energy Crisis Management Simulation for the State of California
[RAND/R-2899-CEC] p 25 N83-20363
Small hydro-electric potential West Poverty Bay region
[DE82-905090] p 26 N83-20412
Cartographic evaluation of environmental-management strategies
[DE82-009828] p 35 N83-22702
- DECISION THEORY**
Decision framework for technology choice Volume 1 A case study of one utility's coal-nuclear choice
[DE82-902213] p 113 N83-18554
- DECOMPOSITION**
Municipal-solid-waste biconversion technologies
[DE83-000263] p 100 N83-16893
Particulate processes in pulverized-coal flames
[DE82-014306] p 140 N83-22367
- DEEP SPACE NETWORK**
An overview of the Goldstone Energy Systems study p 24 N83-19780
Performance simulation of the JPL solar-powered distiller Part 1 Quasi-steady-state conditions -- for cooling microwave equipment p 66 N83-19781
- DEEP WELL INJECTION (WASTES)**
Monitoring well systems in geothermal areas
[DE82-012770] p 133 N83-21586
- DEHUMIDIFICATION**
The development of solar-assisted gas-fired appliances, phase 2
[PB82-231663] p 66 N83-19312
Solar-regenerated desiccant dehumidification
[DE83-900823] p 83 N83-22809
- DEMAND (ECONOMICS)**
Energy plan, 1981
[DE82-902329] p 6 N83-16902
Modeling energy/economy interactions for conservation and renewable energy-policy analysis
[DE82-009159] p 7 N83-16926
Oil and Gas Supply Modeling
[PB82-234139] p 117 N83-19310
Assessment of distributed photovoltaic electric-power systems
[DE83-900531] p 75 N83-21558
Role of energy resources in New Mexico
[DE82-011045] p 20 N83-18592
- DEMOCRAPHY**
A preliminary plan for the development of geothermal energy in the town of Gabbs, Nevada
[DE82-007602] p 17 N83-18064
Ownership and usage of small passenger vehicles Findings from the 1977 National Personal Transportation Study
[DE82-011045] p 20 N83-18592
- DEINITROGENATION**
Catalytic hydrogenation of coal-derived liquids
[DE83-003582] p 126 N83-21068

- DEPLETION**
Development of copper sulfide/cadmium sulfide thin-film solar cells
[DE83-001421] p 74 N83-21539
- DEPOSITION**
Chemical bath deposition of thin film cadmium selenide for photoelectrochemical cells p 38 A83-20594
Studies of the mechanisms of turbine fuel instability
[NASA-CR-167963] p 114 N83-18924
Exploration deliberations p 144 N83-22762
- DEPTH MEASUREMENT**
Laser depth sounding for locating oil below water surface A preliminary survey
[FOA-C-30290-E1] p 98 N83-16753
- DESALINIZATION**
Development and demonstration of a reverse-osmosis energy-recovery device
[PB83-108605] p 140 N83-22380
- DESERTS**
Structural geomorphology of Rajasthan basin, India-interpreted through Landsat imagery and aerial photos p 92 A83-24626
- DESICCANTS**
Performance and operational analysis of a liquid desiccant open-flow solar collector p 49 A83-27246
Competitive assessment of desiccant solar/gas systems for single family residences p 62 N83-18967
Advanced solar/gas desiccant cooling system
[PB82-243833] p 62 N83-18968
Solar-regenerated desiccant dehumidification
[DE83-900823] p 83 N83-22809
- DESIGN ANALYSIS**
MHD channel performance for potential early commercial MHD power plants p 151 A83-23134
A system of criteria for evaluating the energy efficiency of an engine at the state of technical proposals p 1 A83-23437
Size effects in DAWT innovative wind energy system design
[ASME PAPER 82-WA/SOL-20] p 153 A83-25688
Design flexibility of redox flow systems -- for energy storage applications p 189 A83-27177
Design of large, low-concentration-ratio solar arrays for low earth orbit applications p 49 A83-27254
Design and experiences with a laboratory Stirling cycle machine p 157 A83-27284
Program overview and diesel/flywheel hybrid power train design - Fibre composite flywheel development program for road vehicle applications p 190 A83-27306
Fibre composite rotor selection and design /Fibre composite flywheel development program for road vehicle applications/ p 190 A83-27307
The use of mechanical energy storage in an unconventional, rough terrain vehicle p 190 A83-27309
Increasing summer peak power with aquifer storage p 191 A83-27313
On aerodynamic design of the Savonius windmill rotor p 160 A83-27325
Design options for the SP-100 thermoelectric Nuclear Space Power Plant p 160 A83-27327
Mathematical programming models for the economic design and assessment of wind energy conversion systems p 161 A83-27870
Proposal for a new design of wind power generator p 161 A83-27871
Design and construction of a demonstration residence utilizing natural thermal storage p 5 N83-16569
Design study of a high power rotary transformer
[NASA-CR-168012] p 186 N83-16630
Optimal heat pumps for solar-assisted heat-pump systems
[DE82-004798] p 55 N83-16688
Design and fabrication of a prototype system for a photovoltaic residence in the Northeast
[DE82-022497] p 55 N83-16871
Efficient daylighting in thermally controlled environments
[DE82-003045] p 6 N83-16885
Bipolar lead accumulator cell with high energy density
[PB82-258757] p 193 N83-16934
A highly efficient collector for small solar energy installations
[PB82-255191] p 60 N83-16948
Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 1 [BMFT-FB-T-82-151-VOL-1] p 15 N83-18026
Commercial building design and energy conservation A preliminary assessment p 17 N83-18067
Large Horizontal-Axis Wind Turbines
[NASA-CP-2230] p 169 N83-19231

- The response of a 38m horizontal axis teetered rotor to yaw p 169 N83-19232
- Fixed pitch rotor performance of large horizontal axis wind turbines p 169 N83-19233
- Stall induced instability of a teetered rotor p 169 N83-19234
- Free yaw performance of the Mod-0 large horizontal axis 100 kW wind turbine p 170 N83-19235
- Multiple and variable speed electrical generator systems for large wind turbines p 170 N83-19236
- Fiberglass composite blades for the 2 MW Mod-1 wind turbine generator p 170 N83-19241
- Inherent uncertainties in meteorological parameters for wind turbine design p 171 N83-19253
- Experience and assessment of the DOE/NASA Mod-1 2000 kW wind turbine generator at Boone, North Carolina p 172 N83-19257
- Description of the 3 MW SWT-3 wind turbine at San Geronimo Pass, California p 172 N83-19258
- Test status and experience with the 7.5 megawatt Mod-2 wind turbine cluster p 173 N83-19261
- Mod-2 wind turbine project assessment and cluster test plans p 172 N83-19262
- Conceptual design of the 6 MW Mod-5A wind turbine generator p 173 N83-19271
- Conceptual design of the 7 megawatt Mod-5B wind turbine generator p 173 N83-19272
- Initial detailed designs for intermediate photovoltaic systems Branch bank p 65 N83-19287
- [DE82-005854] p 65 N83-19287
- Conceptual design study Standard Floating Nuclear Power Plant on inshore site and Modified Floating Nuclear Power plant on upriver site p 174 N83-19595
- [DE82-007916] p 174 N83-19595
- Liquid-phase methanol process development unit Installation, operation, and support studies p 121 N83-19940
- [DE82-012725] p 121 N83-19940
- Analysis and design of residential load centers Volume 2 Appendices p 24 N83-19956
- [DE82-014253] p 24 N83-19956
- Conceptual design and performance analysis of absorption heat pumps for waste-heat utilization p 186 N83-20060
- [DE82-010202] p 186 N83-20060
- Design, testing, and economics of a 430 W sub p photovoltaic concentrator array for non grid-connected applications p 68 N83-20388
- [DE82-014687] p 68 N83-20388
- Photovoltaic subsystem optimization and design tradeoff study p 69 N83-20392
- [DE82-013393] p 69 N83-20392
- On-site fuel cell power plant technology development program p 176 N83-20437
- [PB83-102335] p 176 N83-20437
- Solar-augmented applications in industry Phase 2 Conceptual designs, volume 1 p 72 N83-20441
- [PB83-102301] p 72 N83-20441
- Energy-storage-flywheel housing-design-concept development p 196 N83-21574
- [DE82-014494] p 196 N83-21574
- Advanced photovoltaic-trough development p 77 N83-21584
- [DE82-015646] p 77 N83-21584
- Performance characteristics and design criteria for the thermic diode, a passive thermosyphon solar heating system p 78 N83-21604
- [DE82-012455] p 78 N83-21604
- Computer-aided industrial process design The ASPEN project p 181 N83-22484
- [DE82-014469] p 181 N83-22484
- Silicon concentrator cell-assembly development p 84 N83-22822
- [DE83-001683] p 84 N83-22822
- Performance criteria for solar heating and cooling systems in residential buildings p 85 N83-22843
- [PB83-122683] p 85 N83-22843
- DESIGN TO COST**
- The loss of power supply probability as a technique for designing stand-alone solar electrical (photovoltaic) systems p 54 A83-29896
- DESORPTION**
- Fundamental research on Fischer-Tropsch synthesis [BMFT-FB-T-82-020] p 125 N83-21052
- DESULFURIZING**
- The kinetics and mechanism of the reaction of ozone with sulphides p 94 N83-16411
- [BLL-OA-TRANS-1934-(6196 3)] p 94 N83-16411
- Coal gasification for stationary gas-turbine applications p 97 N83-18553
- [DE82-902135] p 97 N83-18553
- Development of heat exchangers for reheating scrubbed flue gas in a pilot plant p 13 N83-17840
- [BMFT-FB-T-82-169] p 13 N83-17840
- Testing of heat exchanger systems for reheating flue gases from wet scrubbing desulfurization plants p 13 N83-17841
- [BMFT-FB-T-82-170] p 13 N83-17841
- Desulfurization with transition-metal catalysts p 118 N83-19853
- [DE82-013964] p 118 N83-19853
- Coal desulfurization by a microwave process p 118 N83-19854
- [DE82-007514] p 118 N83-19854
- Acid rain mitigation study Volume 1. FGD cost estimates p 29 N83-20459
- [PB83-101329] p 29 N83-20459
- Acid rain mitigation study Volume 2 FGD cost estimates, appendices p 29 N83-20469
- [PB83-117366] p 29 N83-20469
- Desulphurisation of solid fuels in power stations by superconductive magnets p 125 N83-21051
- [BLL-CE-TRANS-7855-(9022 09)] p 125 N83-21051
- Flue gas desulfurization with waste water evaporation Phase 2 Observation of the experiments at Weiher II [BMFT-FB-T-82-026] p 125 N83-21053
- [DE83-003582] p 126 N83-21068
- Catalytic hydrogenation of coal-derived liquids p 126 N83-21068
- [DE83-003062] p 126 N83-21071
- Desulfurization with transition metal catalysts p 126 N83-21071
- [DE83-003062] p 126 N83-21071
- Review of hot-gas-desulfurization simulation models p 138 N83-22356
- [DE82-016265] p 138 N83-22356
- DETECTION**
- Development of a quiet Stirling cycle multi-fuel engine for electric power generation p 174 N83-19278
- [AD-A121033] p 174 N83-19278
- DETONABLE GAS MIXTURES**
- A study on the hydrogen-oxygen diffusion flame in high speed flow p 93 A83-26199
- DEUTERIUM**
- Tritium transport and control in the FED p 168 N83-18511
- [DE82-002592] p 168 N83-18511
- Utilization of the catalyzed-DD fuel cycle in Reversed-Field Pinch Reactors (RFPRs) p 168 N83-18512
- [DE82-010425] p 168 N83-18512
- DIFFUSION**
- Preliminary evaluation of environmental issues on the use of peat as an energy source p 34 N83-21651
- [DE83-000820] p 34 N83-21651
- DIAMETERS**
- Diffusion flame studies of the chemical and physical mechanisms of soot formation from aromatic and substituted aromatic fuels p 120 N83-19879
- [DE82-009310] p 120 N83-19879
- DIELECTRIC PROPERTIES**
- Materials research for hydrogen-cooled Superconducting Power-Transmission Lines (SPTL) Part 1 Liquid hydrogen as a dielectric Part 2 Superconducting materials p 187 N83-22529
- [DE83-004801] p 187 N83-22529
- DIELECTRICS**
- The generation of electric currents by the turbulent flow of dielectric liquids I - Long pipes p 161 A83-29089
- [DE83-002976] p 161 A83-29089
- Developments and applications of tantalum thin films and hybrid technology p 199 N83-17686
- [BMFT-FB-T-82-173] p 199 N83-17686
- DIESEL ENGINES**
- A wind-diesel energy system for Grimsey, Iceland p 150 A83-22021
- [PB82-250697] p 150 A83-22021
- A systems analysis comparing conventional and hydrogen powered rail locomotives p 87 A83-27213
- [PB82-244013] p 87 A83-27213
- Program overview and diesel/flywheel hybrid power train design - Fibre composite flywheel development program for road vehicle applications p 190 A83-27306
- [GPO-99-748] p 190 A83-27306
- Emulsified fuel testing in a medium speed diesel engine p 98 N83-16564
- [PB82-250697] p 98 N83-16564
- Fiat researchers study ceramics applications in diesels p 199 N83-17760
- [PB82-244013] p 199 N83-17760
- Supercharging with Comprex p 168 N83-18940
- [PB82-244013] p 168 N83-18940
- Diesel Emissions Symposium Proceedings p 23 N83-19462
- [GPO-99-748] p 23 N83-19462
- Diesel technology p 25 N83-20151
- [GPO-99-748] p 25 N83-20151
- Fuel property effects on diesel engine and gas turbine combustor performance p 175 N83-20161
- [AD-A120879] p 175 N83-20161
- Effect of low-proof alcohol fumigation-fueling on crankcase oil dilution in a diesel-cycle engine p 122 N83-20171
- [DE83-002976] p 122 N83-20171
- Refining studies and engine testing of alternative highway-transportation fuels Identification and evaluation of optimized alternative fuels p 129 N83-21172
- [DE83-003332] p 129 N83-21172
- Alternative engine fuels Educational demonstration project p 141 N83-22462
- [DE83-004579] p 141 N83-22462
- DIESEL FUELS**
- Catalytic combustion with steam injection p 93 A83-25271
- [ASME PAPER 82-JPGG-GT-23] p 93 A83-25271
- Propagation at 10 microns through smoke produced by atmospheric combustion of diesel fuel p 3 A83-26641
- [ASME PAPER 82-JPGG-GT-23] p 3 A83-26641
- The properties of fuel fractions obtained by the hydrogenation of Kansk-Achinsk coal p 94 A83-26920
- [ASME PAPER 82-JPGG-GT-23] p 94 A83-26920
- Emulsified fuel testing in a medium speed diesel engine p 98 N83-16564
- [PB82-250697] p 98 N83-16564
- Experimental study of the thermal stability of hydrocarbon fuels p 105 N83-17728
- [NASA-CR-168027] p 105 N83-17728
- Studies of the mechanisms of turbine fuel instability [NASA-CR-167963] p 114 N83-18924
- Hybrid fuel cell/diesel generation total energy system, part 2 p 115 N83-19217
- [NASA-CR-169912] p 115 N83-19217
- Fuel property effects on diesel engine and gas turbine combustor performance p 175 N83-20161
- [AD-A120879] p 175 N83-20161
- Low-temperature pyrolysis of coal to produce diesel-fuel blends p 126 N83-21076
- [DE83-001637] p 126 N83-21076
- Propanol-plus as extender to diesel fuel p 128 N83-21165
- [CSIR-ME-445] p 128 N83-21165
- Motor-fuels for road vehicles p 140 N83-22440
- [REPT-24] p 140 N83-22440
- The Alternative Fuels for Medium Speed Diesel Engines (AFFMSDE) project. A baseline program planning concept for review and revision p 141 N83-22461
- [DE83-002565] p 141 N83-22461
- Alternative engine fuels Educational demonstration project p 141 N83-22462
- [DE83-004579] p 141 N83-22462
- Economic and engineering evaluation of plant oils as a diesel fuel p 141 N83-22464
- [DE83-900805] p 141 N83-22464
- DIFFERENTIAL EQUATIONS**
- Security assessment of power systems including energy storage and with the integration of wind energy Volume 1 Digital transient simulation effort consulting agreement number 1 p 164 N83-16915
- [DE82-021063] p 164 N83-16915
- DIFFUSION**
- Some basic research problems related to energy p 195 N83-21527
- [DE83-003753] p 195 N83-21527
- DIFFUSION COEFFICIENT**
- Diffusion flame studies of the chemical and physical mechanisms of soot formation from aromatic and substituted aromatic fuels p 120 N83-19879
- [DE82-009310] p 120 N83-19879
- DIFFUSION FLAMES**
- Effect of molecular structure on incipient soot formation p 90 A83-19847
- [DE83-002646] p 90 A83-19847
- Prediction of turbulent mixing in confined co-axial reacting jets p 91 A83-23191
- [DE83-002646] p 91 A83-23191
- Joint measurements of radial velocity and scalars in a turbulent diffusion flame p 86 A83-24365
- [DE83-002646] p 86 A83-24365
- A study on the hydrogen-oxygen diffusion flame in high speed flow p 93 A83-26199
- [DE83-002646] p 93 A83-26199
- DIGESTING**
- methods for evaluating the DOE Appropriate-Technology Program A review and compilation of evaluation methods p 145 N83-22781
- [DE83-003306] p 145 N83-22781
- DIGITAL TECHNIQUES**
- ERRSAC contributions to the search for Appalachian hydrocarbons p 114 N83-19155
- [DE83-003306] p 114 N83-19155
- DILUTION**
- Effect of low-proof alcohol fumigation-fueling on crankcase oil dilution in a diesel-cycle engine p 122 N83-20171
- [DE83-002976] p 122 N83-20171
- DIMERS**
- Theoretical studies of solar-pumped lasers p 60 N83-17871
- [NASA-CR-169890] p 60 N83-17871
- DIODES**
- Shading analysis of a photovoltaic-cell string illuminated by a parabolic-trough concentrator p 74 N83-21537
- [DE83-002646] p 74 N83-21537
- Performance characteristics and design criteria for the thermic diode, a passive thermosyphon solar heating system p 78 N83-21604
- [DE82-012455] p 78 N83-21604
- DIRECT CURRENT**
- Preliminary geothermal evaluation of the Mokapu Peninsula on the Island of Oahu, Hawaii p 117 N83-19378
- [AD-A119158] p 117 N83-19378
- Assessment of research directions for high-voltage direct-current power systems p 177 N83-21247
- [DE83-001118] p 177 N83-21247
- DIRECT POWER GENERATORS**
- The calculation of energy storage flywheels of fiber composites with electric energy converter --- German thesis p 191 A83-28666
- [DE82-015149] p 191 A83-28666
- Fuel-cell-propelled submarine-tanker-system study p 183 N83-22827
- [DE82-015149] p 183 N83-22827
- DIRECTORIES**
- The non-Federal oceanographic community An overview p 102 N83-17414
- [NASA-CR-169802] p 102 N83-17414
- DISPERSING**
- Heavy Gas Dispersal p 200 N83-19316
- [VKI-LS-1982-03] p 200 N83-19316
- Introductory lecture Statement of the problem p 200 N83-19317
- [VKI-LS-1982-03] p 200 N83-19317
- Identification of problem areas related to the dispersion of heavy gases p 200 N83-19318
- [VKI-LS-1982-03] p 200 N83-19318

DISPERSIONS

DISPERSIONS

FDAAS hardware and firmware description, Liquefied Gaseous Fuels (LGF) data-acquisition system
[DE82-012602] p 107 N83-17741

DISPLACEMENT

Linear oil displacement by the emulsion entrapment process
[DE82-007751] p 99 N83-16841

DISSOLVED GASES

Analysis of environmental issues related to small-scale hydroelectric development 6 Dissolved oxygen concentrations below operating dams
[DE82-007127] p 22 N83-19329
Dissolved methane concentrations in the southeast Bering Sea, 1980 and 1981
[PB83-112433] p 29 N83-20525

DISSOLVING

Economic incentives for additional critical experimentation applicable to fuel dissolution
[DE82-006818] p 106 N83-17737

DISTILLATION

Trends in motor gasolines, 1942 - 1981
[DE82-021124] p 96 N83-16550
Synthetic-fuel aromaticity and staged combustion
[DE82-010302] p 118 N83-19858

DISTILLATION EQUIPMENT

Performance simulation of the JPL solar-powered distiller Part 1 Quasi-steady-state conditions --- for cooling microwave equipment p 66 N83-19781
Technical/commercial feasibility study of the production of fuel-grade ethanol for corn 100-million gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000772] p 129 N83-21173

DIURNAL VARIATIONS

Gill Harrop, Big Flats, New York solar-energy-system performance evaluation
[DE83-000065] p 57 N83-16895
Intermediate photovoltaic system application experiment operational performance report for Lovington Square Shopping Center, Lovington, New Mexico
[DE83-000391] p 57 N83-16896

DIVING (UNDERWATER)

The importance of satisfactory positioning, diving and mapping systems suitable for exploration and transportation in icecovered sea areas
[PB83-109587] p 123 N83-20342

DOMES (GEOLOGY)

Preliminary design study of compressed-air energy storage in a salt dome Volume 6 CAES plant design
[DE82-014355] p 196 N83-21580

DOMESTIC ENERGY

Preliminary test results for the small community solar power system
[ASME PAPER 82-WA-30] p 44 N83-25687
An analysis of the cost/performance characteristics of passive solar materials and components
p 49 N83-27247

Thermal energy storage - Air Force user considerations in various modes of operation p 190 N83-27305
Potential for domestic heat recovery
[DE82-901395] p 15 N83-18037

Overview of existing residential energy-efficiency rating systems and measuring tools
[DE83-003148] p 20 N83-19289

Federal energy conservation programs Perspectives from the public and private sectors Volume 2 Public hearing, July 14 and 15, 1981, Washington, D.C.
[PB82-238544] p 22 N83-19313

DOPED CRYSTALS

A mechanistic study of oxygen evolution on Li-doped Co3O4 --- by electrolysis p 85 N83-20586
Photoconductivity and photovoltaic effect in indium selenide p 39 N83-22337
Process research of non-cz silicon material Low cost solar array project, cell and module formation research area
[NASA-CR-169899] p 63 N83-19221

DOSIMETERS

Electric power from orbit A critique of a satellite power system
[DE83-002771] p 33 N83-21619

DRILLING

Technologies for Measurement While Drilling
[PB82-243858] p 114 N83-18964
Stratigraphic variations in oil-shale fracture properties
[DE82-021088] p 136 N83-21702
Oil and gas p 34 N83-22674

DROP SIZE

Droplet size effects on NO_x/ formation in a one-dimensional monodisperse spray combustion system
[ASME PAPER 82-JPGC-GT-10] p 93 N83-25268

DROPS (LIQUIDS)

Ground contamination by fuel jettisoned from aircraft in flight p 1 N83-24041

Review of alternative fuels data bases
[NASA-CR-170203] p 140 N83-22439

DRYING

Progress of solar technology and potential farm uses
[PB83-100065] p 71 N83-20436

DRYING APPARATUS

The development of solar-assisted gas-fired appliances, phase 2
[PB82-231663] p 66 N83-19312

DUCTED FLOW

A 2D model of turbulent solar induced flows in passive air collectors p 53 N83-29039

DURABILITY

Solar energy systems Standards for screening plastic containment materials
[PB82-242454] p 62 N83-18921

DUST

Construction and operation of a central heating plant prototype heated by coal dust corresponding to the Schoppe system
[BMFT-FB-T-82-176] p 109 N83-18031
Energy conservation in electrostatic fabric filtration of industrial dust
[DE82-006897] p 15 N83-18036

DYE LASERS

Theoretical studies of solar-pumped lasers
[NASA-CR-169890] p 60 N83-17871

DYES

EA study of solar concentrator panels with fluorescent compounds p 40 N83-22911
Use of inorganic materials for phosphorescent concentrating solar cells
[DE83-002860] p 83 N83-22799

DYNAMIC CHARACTERISTICS

Load following impacts of a large wind farm on an interconnected electric utility system
p 151 N83-22675

A review of utility issues for the integration of wind electric generators p 173 N83-19269
Development of methodology for horizontal axis wind turbine dynamic analysis
[NASA-CR-168110] p 181 N83-22747

DYNAMIC MODELS

Penetration for four solar technologies in electric utilities and the environmental benefits
[DE82-010864] p 59 N83-16927
Oil and Gas Supply Modeling
[PB82-234139] p 117 N83-19310
The application of DOE-2 in the predesign phase of commercial-building design
[DE82-014067] p 31 N83-21201

DYNAMIC PRESSURE

The effects of tower shadow on the dynamics of a horizontal-axis wind turbine p 160 N83-27869

E

EARTH ATMOSPHERE

The effects of atmospheric variability on energy utilization and conservation
[DE83-003612] p 31 N83-21525

EARTH CORE

Technologies for Measurement While Drilling
[PB82-243858] p 114 N83-18964

EARTH OBSERVATIONS (FROM SPACE)

Main advances and needs on the study of geothermal resources in Chile by using remote sensing techniques
p 91 N83-21946

EARTH ORBITS

Low concentration ratio solar array for low Earth orbit multi-100 kW application
[NASA-CR-170729] p 67 N83-20360

EARTH RESOURCES

Uranium hydrogeochemical and stream sediment reconnaissance of the St Michael NTMS quadrangle, Alaska
[DE82-009999] p 99 N83-16844

Peat-resource estimation in New York State
[DE82-005156] p 108 N83-18007
Recovery of minerals from US coals
[DE82-008173] p 108 N83-18010

Energy development on Native American lands Resources and attitudes An interpretive report on two major Indian conferences of 1980
[DE82-009539] p 17 N83-18076

Site selection and characterization for an underground coal gasification test in Washington State Volume 2 Project details
[DE82-010948] p 19 N83-18117

Energy resources in New Mexico Oil and gas, coal, electrical generation, uranium, and geothermal energy
[DE83-900485] p 142 N83-22672

EARTH SATELLITES

Study of psychophysiological distinctions of primates using delayed reaction test p 85 N83-26442

EARTH SURFACE

The use of mechanical energy storage in an unconventional, rough terrain vehicle p 190 N83-27309

ECOLOGY

Acid precipitation A critique of present knowledge and proposed action
[DE83-900303] p 34 N83-21650
Pressing problems of radioecology in light of solving atomic energy problems p 36 N83-22777

ECONOMIC ANALYSIS

Solar/gas Rankine/Rankine-cycle heat pump assessment
[PB82-254863] p 55 N83-16710
Solar-photovoltaic power for broadcasting stations An economic analysis
[DE82-022498] p 55 N83-16873

Wind system value analysis for electric utilities A comparison of four methods
[DE82-006963] p 164 N83-16883

Economic evaluation of solar energy systems in commercial buildings Methodology and case studies
[PB82-260456] p 165 N83-16938

Economic incentives for additional critical experimentation applicable to fuel dissolution
[DE82-006818] p 106 N83-17737

Renewable energy system feasibility study
[AD-A12152] p 15 N83-18035

The energy transition and the macroeconomy A framework for policy analysis
[DE82-007839] p 16 N83-18039

Evaluation of the mathematical and economic basis for conversion processes in the LEAP energy-economy model
[DE83-001706] p 167 N83-18079

Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States
[DE82-011237] p 18 N83-18108

Energy and life-cycle cost analysis of a six-story office building
[DE82-004840] p 20 N83-18963

Economics of wind energy for utilities
p 116 N83-19270

Study of domestic social and economic impacts of Ocean Thermal Energy Conversion (OTEC) commercial development Volume 1 Economic impacts
[DE83-001111] p 21 N83-19291

Economic feasibility of solar thermal industrial applications and selected case studies
[DE82-009503] p 66 N83-19303

Oil and Gas Supply Modeling
[PB82-234139] p 117 N83-19310

World oil model development
[DE82-013979] p 25 N83-20334

Design, testing, and economics of a 430 W sub p photovoltaic concentrator array for non grid-connected applications
[DE82-014687] p 68 N83-20388

Solar electric technologies Methods of electric utility value analysis
[DE82-014285] p 71 N83-20409

Federal applications for wind energy systems A subcontract report
[DE83-000306] p 31 N83-21543

Geothermal energy in Nevada Development and utilization
[DE83-001783] p 31 N83-21545

Ventilated wall and window test passive-solar concept
[DE83-900824] p 78 N83-21614

Performance and economics of residential solar space heating
[DE83-003187] p 79 N83-21626

Performance and economics of 8 alternative systems for residential heating, cooling, and water heating in 115 US cities
[DE83-003196] p 33 N83-21630

Economic and engineering evaluation of plant oils as a diesel fuel
[DE83-900805] p 141 N83-22464

Role of energy resources in New Mexico
p 34 N83-22673

Coal p 143 N83-22675
DOE small-scale hydroelectric demonstration program
F W E Staphenhorst, Inc., Goodyear Lake hydroelectric-generating-station redevelopment
[DE83-003156] p 182 N83-22780

Assessment of the need for dry cooling, 1981 update
[DE82-009395] p 146 N83-22803

ECONOMIC DEVELOPMENT

Energy projections to the year 2000, July 1982 update
[DE82-022523] p 5 N83-16870

Status of the Great Plains Coal Gasification Project, August 1982
[GAO/EMD-82-117] p 115 N83-19230

SUBJECT INDEX

- Small hydro-electric potential West Poverty Bay region
[DE82-905090] p 26 N83-20412
- ECONOMIC FACTORS**
- Mathematical programming models for the economic design and assessment of wind energy conversion systems p 161 A83-27870
- Two global scenarios The evolution of energy use and the economy to 2030
[IIASA-RR-81-35] p 14 N83-18021
- Comparative values of advanced space solar cells [NASA-TM-84951] p 60 N83-18023
- The role of business incentives in the development of renewable energy technologies
[GPO-99-651] p 25 N83-20364
- Small hydro-electric potential West Poverty Bay region
[DE82-905090] p 26 N83-20412
- Physics of mirror systems
[DE82-015908] p 176 N83-20770
- Passive-solar homes for Texas
[DE83-900806] p 83 N83-22818
- ECONOMIC IMPACT**
- A practical economic criterion for fuel conservation p 12 N83-17468
- Study of domestic social and economic impacts of Ocean Thermal Energy Conversion (OTEC) commercial development Volume 1 Economic impacts
[DE83-001111] p 21 N83-19291
- Study of domestic social and economic impacts of Ocean Thermal Energy Conversion (OTEC) commercial development Volume 2 Industry profiles
[DE83-001112] p 21 N83-19292
- Assessment of distributed photovoltaic electric-power systems
[DE83-900531] p 75 N83-21558
- Assessment of distributed solar power systems Issues and impacts
[DE83-900640] p 78 N83-21618
- Roadway-powered electric-vehicle impact study analysis of selected utility-service areas
[DE83-003143] p 180 N83-22030
- Methods for evaluating the DOE
Appropriate-Technology Program A review and compilation of evaluation methods
[DE83-003306] p 145 N83-22781
- Hydrogen use in a rural Alaskan community
[DE83-000568] p 90 N83-22813
- Roadway-powered electric-vehicle project
[DE83-003147] p 184 N83-23243
- ECONOMICS**
- Analytical and policy issues in energy economics Uses of the FRS data base
[DE82-004258] p 16 N83-18051
- Study of domestic social and economic impacts of Ocean Thermal Energy Conversion (OTEC) commercial development Volume 2 Industry profiles
[DE83-001112] p 21 N83-19292
- The design, effectiveness and construction of passive-thermal-control roofing shingles
[DE83-001465] p 75 N83-21557
- Design approaches for solar industrial process-heat systems Nontracking and line-focus collector technologies
[DE83-003339] p 79 N83-21620
- Role of water in energy development
[DE82-011986] p 35 N83-22800
- ECONOMY**
- Two global scenarios The evolution of energy use and the economy to 2030
[IIASA-RR-81-35] p 14 N83-18021
- Alaskan coal Resources and developmental constraints
[DE83-000860] p 130 N83-21494
- Ignition technique for conventional motors by high energy spark
[INPE-2645-TDL/116] p 142 N83-22594
- ECOSYSTEMS**
- Statistical database management for ecosystem-effects analysis
[DE82-005199] p 18 N83-18104
- Geotoxic materials in the surface environment
[DE82-005855] p 23 N83-19333
- EDDY CURRENTS**
- Power factor controllers p 80 N83-22510
- EDDY VISCOSITY**
- Boundary-layer control by means of strong injection
[DE82-012547] p 142 N83-22568
- EDGE LOADING**
- Contact stresses on a thin plate after large displacements to a half parabolic surface
[DE82-006998] p 63 N83-19136
- EDUCATION**
- Passive-Solar Commercial Buildings Program, 1980 - 1982
[DE82-012472] p 72 N83-21202

- EFFICIENCY**
- Efficient daylighting in thermally controlled environments
[DE82-003045] p 6 N83-16885
- Comparative report Performance of solar hot-water systems, 1980 - 1981
[DE83-000069] p 56 N83-16889
- Intermediate photovoltaic system application experiment operational performance report for Lovington Square Shopping Center, Lovington, New Mexico
[DE83-000391] p 57 N83-16896
- Solar-absorber-selective paint research
[DE82-006104] p 61 N83-18050
- The energy of the ocean thermal resource and the second-law efficiency of idealized ocean thermal energy conversion power cycles
[DE83-000449] p 167 N83-18071
- Residential and commercial cogeneration systems assessment
[PB82-240037] p 22 N83-19314
- Energy-efficient alcohol-fuel production
[DE82-011278] p 122 N83-19944
- Energy inputs and outputs of fuel-alcohol production, appendices G and H Methanol from coal
[DE83-000370] p 130 N83-21177
- Performance optimization of the ASR optical module
[DE83-004477] p 82 N83-22797
- Multi-fuel low-NOx burner development, phase 2
[PB83-126292] p 147 N83-22845
- EFFLUENTS**
- Leachate-treatment technique utilizing fly ash as low-cost sorbent
[DE82-010501] p 111 N83-18101
- Publications in life sciences synthetic fuels of Oak Ridge National Laboratory
[DE83-001701] p 122 N83-19945
- EJECTORS**
- Steam ejector as an industrial heat pump
[DE82-010194] p 14 N83-17847
- ELASTIC DEFORMATION**
- Effects of gaps in adhesives that bond elastically deformed panels to parabolic, cylindrical substructures
[DE82-014720] p 72 N83-21154
- Deformation of a thin, elastic plate to a deep parabolic cylinder
[DE82-012056] p 72 N83-21413
- Stress analysis of spherical mirror panels
[DE82-015656] p 77 N83-21585
- ELASTIC PROPERTIES**
- Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures
[AD-A113883] p 72 N83-20802
- ELECTRIC AUTOMOBILES**
- Comparison of Na/S and LiAl/FeS batteries
p 188 A83-27169
- Acid fuel cell technologies for vehicular power plants
p 154 A83-27185
- Status of solid polymer electrolyte fuel cell technology and potential for transportation applications
p 154 A83-27186
- A comparison of alternative energy storage systems for automobiles
[PB82-249954] p 174 N83-19309
- Tests of an alternating current propulsion subsystem for electric vehicles on a road load simulator
[NASA-TM-83036] p 182 N83-22749
- ELECTRIC BATTERIES**
- Integration of large electrical space power systems
p 46 A83-27153
- Comparison of Na/S and LiAl/FeS batteries
p 188 A83-27169
- Large nickel alkaline batteries
p 189 A83-27176
- Sealed mini-nickel cadmium battery charging techniques, technical investigation report
[AD-A119826] p 192 N83-16860
- Physical chemistry of molten-salt batteries
Current-induced composition gradients in molten LiCl-KCl
[DE83-001684] p 192 N83-16875
- Development of advanced batteries for utility application
[DE82-906459] p 193 N83-16918
- Assessment of battery buses and battery technology
[PB82-260019] p 11 N83-17428
- Health and environmental effects document for batteries, 1981 The zinc/halogen batteries
[DE82-006987] p 23 N83-19331
- The electrochemical fluorination of polymers materials for high energy density aqueous and non-aqueous battery and fuel cell separators
[NASA-CR-167961] p 177 N83-21056

ELECTRIC MOTOR VEHICLES

- Development and demonstration of process and components for the control of aluminum-air-battery electrolyte composition through the precipitation of aluminum trihydroxide
[DE83-002490] p 180 N83-21623
- Synthetic fuels for transportation Background paper 1 The future potential of electric and hybrid vehicles
[PB83-126086] p 37 N83-23250
- ELECTRIC CURRENT**
- Development of copper sulfide/cadmium sulfide thin-film solar cells
[DE83-001421] p 74 N83-21539
- ELECTRIC DISCHARGES**
- Technology of elevated voltage solar arrays Key items test and evaluation Part 2 Simulated LEO-plasma tests
[ESA-CR(P)-1646] p 73 N83-21513
- ELECTRIC ENERGY STORAGE**
- Electricity from wind - A survey of the state of the art and future prospects for research and development
[DGLR PAPER 82-081] p 152 A83-24202
- A zinc paste primary battery --- for electric vehicles
p 153 A83-26052
- Application of microprocessor-based controls in an ac/dc power conversion system p 188 A83-27151
- Application of electrochemical energy storage in solar thermal electric generation systems p 47 A83-27179
- Analysis of fixed-base flywheel systems for electric utility applications p 190 A83-27310
- The calculation of energy storage flywheels of fiber composites with electric energy converter --- German thesis
p 191 A83-28666
- A comparison of alternative energy storage systems for automobiles
[PB82-249954] p 174 N83-19309
- ELECTRIC EQUIPMENT TESTS**
- Contemporary electric vehicle testing and evaluation
p 3 A83-27160
- ELECTRIC GENERATORS**
- The generation of electric currents by the turbulent flow of dielectric liquids I - Long pipes p 161 A83-29089
- Stochastic methods for analysis of power flow in electric networks
[DE83-000445] p 5 N83-16653
- Research on spacecraft electrical power conversion
[NASA-CR-169974] p 20 N83-19227
- Status of DOE small hydropower research and development projects
[DE83-001353] p 125 N83-20434
- Desulphurisation of solid fuels in power stations by superconductive magnets
[BLL-CE-TRANS-7855-(9022 09)] p 125 N83-21051
- Electric home heating Substitution for oil and gas
[DE82-013762] p 133 N83-21581
- National forecast for geothermal resource exploration and development with techniques for policy analysis and resource assessment
[DE82-014641] p 133 N83-21588
- The acquisition of wind rights for wind energy development
[DE82-009139] p 32 N83-21597
- Energy from humid air
[DE82-017121] p 180 N83-21601
- Energy resources in New Mexico Oil and gas, coal, electrical generation, uranium, and geothermal energy
[DE83-900485] p 142 N83-22672
- Electrical generation
[DE83-003156] p 143 N83-22676
- Cogeneration and small power production
[GPO-99-464] p 35 N83-22752
- Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, Part 1 Turbomachinery design
[DE83-004005] p 197 N83-22759
- DOE small-scale hydroelectric demonstration program F W E Stapenhorst, Inc., Goodyear Lake hydroelectric-generating-station redevelopment
[DE83-003156] p 182 N83-22780
- ELECTRIC HYBRID VEHICLES**
- Electric vehicles in electric utilities A national survey
[DE82-901285] p 5 N83-16655
- Assessment of battery buses and battery technology
[PB82-260019] p 11 N83-17428
- Roadway-powered electric-vehicle project
[DE83-003147] p 184 N83-23243
- Synthetic fuels for transportation Background paper 1 The future potential of electric and hybrid vehicles
[PB83-126086] p 37 N83-23250
- ELECTRIC IGNITION**
- Ignition technique for conventional motors by high energy spark
[INPE-2645-TDL/116] p 142 N83-22594
- ELECTRIC MOTOR VEHICLES**
- A zinc paste primary battery --- for electric vehicles
p 153 A83-26052
- The relative attractiveness of electric and hybrid passenger cars
p 3 A83-27159

- Contemporary electric vehicle testing and evaluation p 3 A83-27160
- An advanced electric vehicle powertrain p 154 A83-27161
- Energy utilization of electric and hybrid vehicles p 188 A83-27164
- A systems analysis comparing conventional and hydrogen powered rail locomotives p 87 A83-27213
- Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment [NASA-CR-169801] p 191 N83-16858
- Health and environmental effects document for batteries, 1981 The zinc/halogen batteries [DE82-006987] p 23 N83-19331
- Route profile analysis to determine suitability of electric postal-delivery vehicles p 29 N83-20842
- Roadway-powered electric-vehicle impact study analysis of selected utility-service areas [DE83-003143] p 180 N83-22030
- Tests of an alternating current propulsion subsystem for electric vehicles on a road load simulator [NASA-TM-83036] p 182 N83-22749
- ELECTRIC NETWORKS**
- Stochastic methods for analysis of power flow in electric networks [DE83-000445] p 5 N83-16653
- Dynamic interaction between an OTEC power plant and a power grid --- ocean thermal energy conversion [DE83-002862] p 183 N83-22784
- ELECTRIC POTENTIAL**
- Photovoltaic array Power conditioner interface characteristics [NASA-CR-169919] p 64 N83-19225
- Analytical investigation of critical MHD phenomena [NASA-CR-168079] p 169 N83-19228
- The response of solar cells to microwave radiation [AD-A121813] p 64 N83-19279
- Intermediate photovoltaic system application experiment operational performance report Volume 5 for Lovington Square Shopping Center, Lovington, NM [DE82-006877] p 65 N83-19286
- Development of copper sulfide/cadmium sulfide thin-film solar cells [DE83-001421] p 74 N83-21539
- Photovoltaic 1-5 curve measurement techniques [DE83-000447] p 80 N83-22534
- ELECTRIC POWER**
- Solar electric technologies Methods of electric utility value analysis [DE82-014285] p 71 N83-20409
- ELECTRIC POWER PLANTS**
- Load following impacts of a large wind farm on an interconnected electric utility system p 151 A83-22675
- MHD channel performance for potential early commercial MHD power plants p 151 A83-23134
- Electric power - Looking at regenerative systems p 43 A83-24353
- Ocean thermal-energy conversion p 152 A83-25125
- Assessment of phosphoric acid and trifluoromethane sulfonic acid fuel cells for vehicular powerplants p 154 A83-27162
- OTEC plants for today's island market p 156 A83-27227
- Design, fabrication, and initial testing of solar one receiver p 47 A83-27229
- Cogeneration using a thermionic combustor p 159 A83-27300
- Solar thermionic energy converter experiment p 51 A83-27301
- Critique of conceptual design for removal of sodium from lignite by ion exchange [DE82-010789] p 95 N83-16439
- Investigation of methanol as a boiler fuel for electric-power generation [DE82-905495] p 97 N83-16560
- Coal as an option for power generation in US territories of the Pacific [DE82-009462] p 98 N83-16563
- Wind system value analysis for electric utilities A comparison of four methods [DE82-006963] p 164 N83-16883
- Performance and operational experience of a prototype binary geothermal power plant [DE82-006289] p 164 N83-16901
- Benefits to utility systems of coproduction of methanol and electricity [DE83-900279] p 101 N83-16913
- Landfill gas to electricity demonstration project [PB82-255290] p 7 N83-16943
- Penetration and air-emission-reduction benefits of solar technologies in the electric utilities [DE82-002637] p 9 N83-16971

- Compressed-air energy storage Preliminary design and site-development program in an aquifer Volume 3 Site-selection study, part 2 [DE83-001252] p 194 N83-18074
- Estimating pollutant exposures from coal fired power plants in a rural region [DE82-008136] p 19 N83-18109
- Integration of Wind Turbine Generation (WTG) into utility generating systems p 171 N83-19249
- Development of a quiet Stirling cycle multi-fuel engine for electric power generation [AD-A121033] p 174 N83-19278
- Generic environmental and safety assessment of 5 battery energy-storage systems [DE82-902212] p 23 N83-19334
- Integrated forecasting model synthetic fuels study Volume 1 Overview and findings [DE82-903574] p 121 N83-19943
- Materials for Coal Conversion and Utilization [DE82-013244] p 124 N83-20386
- Present and potential use of micro-hydroelectric schemes in remote locations [DE82-904687] p 26 N83-20411
- Oxygen supply for coal gasification power stations (combined cycle process) [BMFT-FB-T-82-018] p 131 N83-21505
- Systems analysis of on-site integrated energy systems, phase 1 [DE83-000044] p 179 N83-21549
- Electric-utility value determination for wind energy Volume 2 A user's guide [DE82-010926] p 134 N83-21596
- Assessment of distributed solar power systems Issues and impacts [DE83-900640] p 78 N83-21618
- Dynamic interaction between an OTEC power plant and a power grid --- ocean thermal energy conversion [DE83-002862] p 183 N83-22784
- Assessment of distributed photovoltaic electric-power systems [DE83-900566] p 187 N83-22788
- Assessment of the need for dry cooling, 1981 update [DE82-009395] p 146 N83-22803
- ELECTRIC POWER SUPPLIES**
- Configuration selection study for isolated loads --- using parabolic dish modules to supply power for MX shelters p 41 A83-23137
- Spacecraft power technology p 153 A83-27157
- Low power, air-cooled DC-Link aircraft generation systems p 159 A83-27324
- The loss of power supply probability as a technique for designing stand-alone solar electrical (photovoltaic) systems p 54 A83-29896
- Analysis and design of residential load centers Volume 2 Appendices [DE82-014253] p 24 N83-19956
- US electric power system reliability [GPO-99-628] p 24 N83-20002
- South Carolina energy outlook [DE83-002121] p 32 N83-21561
- Intermediate photovoltaic system application experiment operational executive summary Volume 7 Newman Power Station, El Paso, Texas [DE82-014647] p 76 N83-21564
- Reentry thermal testing of a general purpose heat source fueled clad [DE82-014125] p 184 N83-23146
- ELECTRIC POWER TRANSMISSION**
- Design study of a high power rotary transformer [NASA-CR-168012] p 186 N83-16630
- Electric vehicles in electric utilities A national survey [DE82-901285] p 5 N83-16655
- Electric system impacts of storage heating and storage water heating, part 2 [DE81-032010] p 192 N83-16863
- Environmental impacts of undergrounding high-voltage transmission Health and safety [DE82-010108] p 186 N83-18102
- The 80 megawatt wind power project at Kahuku Point, Hawaii p 172 N83-19264
- Economics of wind energy for utilities p 116 N83-19270
- US electric power system reliability [GPO-99-628] p 24 N83-20002
- Assessment of distributed photovoltaic electric-power systems [DE83-900566] p 187 N83-22788
- ELECTRIC PROPULSION**
- Assessment of battery buses and battery technology [PB82-260019] p 11 N83-17428
- ELECTRIC RELAYS**
- High-cycle-life, high-energy-density nickel-zinc batteries [DE82-012896] p 195 N83-20376

ELECTRIC SWITCHES

- Solar array switching power management p 45 A83-27132
- Repetitive switching for inductive energy storage [AD-A121029] p 194 N83-19277
- ELECTRICAL ENGINEERING**
- Federal Technology Catalog 1982: Summaries of practical technology [PB83-121533] p 200 N83-22480
- ELECTRICAL FAULTS**
- Analytical investigation of axial field limitations in MHD generators p 151 A83-23126
- Electrical overstress failure in silicon solar cells [DE83-004475] p 80 N83-21637
- Materials research for hydrogen-cooled Superconducting Power-Transmission Lines (SPTL) Part 1 Liquid hydrogen as a dielectric Part 2 Superconducting materials [DE83-004801] p 187 N83-22529
- ELECTRICAL PROPERTIES**
- Photoelectrochemical behaviour of electrodeposited and pressure-sintered Bi₂S₃, Bi₂S₃-PbS and Bi₂S₃-Ag₂S semiconductor electrodes p 40 A83-22905
- Accuracy of analytical expressions for solar cell fill factors p 41 A83-22914
- Research on spacecraft electrical power conversion [NASA-CR-169974] p 20 N83-19227
- ELECTRICAL RESISTANCE**
- Electric load of resistance heated one-family houses An empirical analysis [DE82-901536] p 6 N83-16923
- Evaluation of various solar-cell-to-interconnector welds by means of scanning laser acoustic microscopy and metallography [ESA-STM-225] p 73 N83-21514
- Geothermal p 143 N83-22678
- ELECTRICAL RESISTIVITY**
- Evaluation of tetrafluoroethane-1,2-disulfonic acid as a fuel cell electrolyte p 161 A83-28300
- Developments and applications of tantalum thin films and hybrid technology [BMFT-FB-T-82-173] p 199 N83-17686
- ELECTRICITY**
- Electric load of resistance heated one-family houses An empirical analysis [DE82-901536] p 6 N83-16923
- Congeneration feasibility Otis Elevator Company and Polychrome Corporation [PB82-263526] p 7 N83-16942
- Analysis and design of residential load centers Volume 2 Appendices [DE82-014253] p 24 N83-19956
- Electric home heating Substitution for oil and gas [DE82-013762] p 133 N83-21581
- Intermediate photovoltaic system experiment operational performance report Volume 3 For G N Wilcox Memorial Hospital, Kauai, Hawaii [DE83-000801] p 84 N83-22830
- ELECTROCHEMICAL CELLS**
- Electrophoretically deposited CdS and CdSe anodes for photoelectrochemical cells p 149 A83-19883
- Application of electrochemical energy storage in solar thermal electric generation systems p 47 A83-27179
- Pore size engineering applied to starved electrochemical cells and batteries p 154 A83-27201
- Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment [NASA-CR-169801] p 191 N83-16858
- Investigation of intercalated compounds for photoelectrochemical energy storage [DE83-000543] p 192 N83-16899
- Study of the electrowinning of copper using a fluidized-bed electrochemical reactor [DE83-004854] p 181 N83-22404
- ELECTROCHEMICAL OXIDATION**
- Methane synthesis on nickel by a solid-state ionic method p 91 A83-22324
- ELECTROCHEMISTRY**
- Workshop on the Status of Industrial Organic Electrochemistry, summary [DE82-901982] p 103 N83-17647
- The electrochemical fluorination of polymeric materials for high energy density aqueous and non-aqueous battery and fuel cell separators [NASA-CR-167961] p 177 N83-21056
- Electromigrational composition gradients in molten carbonates A review [DE83-002593] p 177 N83-21075
- Development and demonstration of process and components for the control of aluminum-air-battery electrolyte composition through the precipitation of aluminum trihydroxide [DE83-002490] p 180 N83-21623
- Nickel-zinc batteries [DE83-000208] p 197 N83-22770

SUBJECT INDEX

ELECTRODEPOSITION

- Electrophoretically deposited CdS and CdSe anodes for photoelectrochemical cells p 149 A83-19883
- Thermal degradation of solar collector surfaces p 44 A83-25535

- Variation in the microstructure of electrodeposited black chrome solar coatings [DE81-030842] p 56 N83-16878

ELECTRODES

- Basic investigation into the electrical performance of solid electrolyte membranes [NASA-CR-169790] p 191 N83-16419

- Bipolar lead accumulator cell with high energy density [PB82-258757] p 193 N83-16934

- Development of gas-phase metallized plaques for electrodes of storage batteries, in particular for nickel oxide electrodes [PB82-255431] p 193 N83-16950

- Semiconductor photoelectrochemistry [NASA-TP-2088] p 167 N83-18024

- Chalcogenophosphate photoelectrodes [NASA-CASE-LAR-12958-1] p 60 N83-18025

- Analytical investigation of critical MHD phenomena [NASA-CR-168079] p 169 N83-19228

- Prospects for the development of non-noble metal catalysts for hydrogen-air fuel cells [DE82-013875] p 176 N83-20422

- Flash photoelectrochemical studies of transient electrode processes important in solar-energy conversion [DE83-003134] p 76 N83-21560

ELECTROLYSIS

- Photoelectrolysis of water under visible light with doped SrTiO₃ electrodes p 38 A83-20580

- A mechanistic study of oxygen evolution on Li-doped Co₃O₄ --- by electrolysis p 85 A83-20586

- Present status of R&D for hydrogen production from water in Japan p 86 A83-23701

- On-site production of electrolytic hydrogen for generator cooling p 86 A83-27209

- Current research in advanced water electrolysis in the United States and abroad p 87 A83-27216

- HYFIRE A Tokamak/high-temperature electrolysis system [DE82-004806] p 88 N83-17323

- Flash photoelectrochemical studies of transient electrode processes important in solar-energy conversion [DE83-003134] p 76 N83-21560

- Status of the cadmium thermoelectrochemical hydrogen cycle [DE83-900088] p 89 N83-22349

- HYFIRE A Tokamak/high-temperature electrolysis system [DE82-013851] p 90 N83-23173

ELECTROLYTES

- Pore size engineering applied to starved electrochemical cells and batteries p 154 A83-27201

- Evaluation of tetrafluorethane-1,2-disulfonic acid as a fuel cell electrolyte p 161 A83-28300

- Development of advanced batteries for utility application [DE82-906459] p 193 N83-16918

- Fuel cell electrolyte for portable electrical generating equipment [AD-A121176] p 174 N83-19275

- Development and demonstration of process and components for the control of aluminum-air-battery electrolyte composition through the precipitation of aluminum trihydroxide [DE83-002490] p 180 N83-21623

- Computer-aided industrial process design The ASPEN project [DE82-014469] p 181 N83-22484

ELECTROLYTIC CELLS

- Fuel cell electrolyte for portable electrical generating equipment [AD-A121176] p 174 N83-19275

- Feasibility evaluation of fuel cells for selected heavy-duty transportation systems [DE83-002953] p 179 N83-21550

ELECTROMAGNETIC FIELDS

- Controlled source audio-magnetotelluric (CSMAT) resistivity measurements for in-situ combustion [DE82-016398] p 120 N83-19877

ELECTROMAGNETIC PROPERTIES

- Development of High Frequency Electromagnetic Mapping (HFEM) technology [DE82-012773] p 122 N83-19998

ELECTROMECHANICAL DEVICES

- The calculation of energy storage flywheels of fiber composites with electrical energy converter --- German thesis p 191 A83-28666

ELECTROMIGRATION

- Electromigrational composition gradients in molten carbonates A review [DE83-002593] p 177 N83-21075

ELECTRON BEAMS

- Polycrystalline solar cell/substrate growth by integrated vacuum evaporation [DE82-017203] p 58 N83-16917

ELECTRON BOMBARDMENT

- Optimization of pulling conditions by electronic bombardment of polycrystalline silicon ribbons for solar cells --- French thesis p 55 A83-29946

ELECTRON DENSITY (CONCENTRATION)

- Measurement of plasma conductivity using Faraday rotation of submillimeter waves p 151 A83-23139

ELECTRON DIFFUSION

- Influence of diffusion of hot carriers on collection efficiency of solar cells - a-Si:H p 42 A83-23665

- Diffusion length determination in n+/p-p+/p+ structure based silicon solar cells from the intensity dependence of the short-circuit current for illumination from the p+/p+ side p 52 A83-27982

ELECTRON MICROSCOPY

- Relationship between pyrite formation and organic sulfur content of coal as revealed by electron microscopy [DE82-010417] p 104 N83-17652

ELECTRON MOBILITY

- Electromigrational composition gradients in molten carbonates A review [DE83-002593] p 177 N83-21075

ELECTRON PLASMA

- Measurement of plasma conductivity using Faraday rotation of submillimeter waves p 151 A83-23139

ELECTRON STATES

- The uranyl ion, fluorescent and fluorone-like - A review p 45 A83-26061

ELECTRON TRANSFER

- Photo-induced electron-transfer reactions in heterogeneous media [DE82-005767] p 66 N83-19627

- Photobiology task of the advanced solar energy research program [DE82-012310] p 71 N83-20417

ELECTRON TUNNELING

- Development of copper sulfide/cadmium sulfide thin-film solar cells [DE83-001421] p 74 N83-21539

ELECTRONIC CONTROL

- An advanced electric vehicle powertrain p 154 A83-27161

ELECTRONICS

- West Europe report Science and technology, no. 134 [JP85-82686] p 199 N83-17761

ELECTROPLATING

- Development of technique for air coating and nickel and copper metallization of solar cells [NASA-CR-169938] p 63 N83-19222

ELECTROSTATICS

- Energy conservation in electrostatic fabric filtration of industrial dust [DE82-006897] p 15 N83-18036

- Demonstration of a solar/wind-powered electrostatic-field food-keeping device [DE82-007971] p 65 N83-19285

ELECTROWINNING

- Study of the electrowinning of copper using a fluidized-bed electrochemical reactor [DE83-004854] p 181 N83-22404

ELEVATION ANGLE

- Solar altitude frequency tables p 39 A83-22617

EMERGENCIES

- An approach to helicopter power selection p 3 A83-24828

EMISSION

- Evaluation of the maintenance effect on fugitive emissions from refineries in the south coast air quality management district [PB82-239260] p 23 N83-19356

EMISSIVITY

- An improved portable thermoradiometer /TRM/ for measuring the relative emissivity of solids at room temperature p 39 A83-20959

- Solar-collector materials exposure to the IPH site environment Task 5 0 [DE83-002192] p 62 N83-18072

EMULSIONS

- Emulsified fuel testing in a medium speed diesel engine [PB82-250697] p 98 N83-16564

- Linear oil displacement by the emulsion entrapment process [DE82-007751] p 99 N83-16841

ENCAPSULATING

- Industrial technology for economic and viable encapsulation for large solar panels [PB82-259839] p 59 N83-16936

ENERGY CONSERVATION

- Development of copper sulfide/cadmium sulfide thin-film solar cells [DE83-001421] p 74 N83-21539

- Parametric investigations and other related studies of energy storage type capacitors [DE83-003426] p 197 N83-22785

ENDOTHERMIC REACTIONS

- The 5 MW for solar-chemistry development [DE82-002064] p 60 N83-18043

ENERGY BANDS

- A new strategy for efficient solar energy conversion - Parallel-processing with surface plasmons p 46 A83-27140

ENERGY CONSERVATION

- Twenty years of experience with organic Rankine cycle turbines - Their applicability and use in energy conservation and alternative energy systems p 3 A83-27207

- R and D of energy saving and new energy utilization in Japanese marine engineering p 4 A83-27225

- Energy conservation in air transportation - The Canadian Air Traffic Control Effort p 4 A83-29393

- Design and construction of a demonstration residence utilizing natural thermal storage [DE82-005508] p 5 N83-16569

- The assessment of variable valve timing of internal combustion engines for fuel economy improvements and practicability [PB82-265364] p 5 N83-16766

- Energy projections to the year 2000, July 1982 update [DE82-022523] p 5 N83-16870

- Design and fabrication of a prototype system for a photovoltaic residence in the Northeast [DE82-022497] p 55 N83-16871

- Energy audits at 48 hospitals [DE82-002814] p 5 N83-16884

- Analysis of energy use at US institutional buildings [DE82-004670] p 6 N83-16886

- Energygrams Brief descriptions of energy technology [DE82-003278] p 199 N83-16891

- Energygrams Brief descriptions of energy technology [DE82-003277] p 199 N83-16892

- Energy plan, 1981 [DE82-902329] p 6 N83-16902

- Energy Conservation in Historic Structures An information/awareness bulletin [DE82-005212] p 6 N83-16903

- Cogeneration in Municipalities Proceedings from Workshops for Local Governments and Municipal Utilities [DE82-905758] p 6 N83-16921

- Evaluation of utility home-energy-audit programs A Wisconsin example [DE82-008134] p 6 N83-16924

- Energy optimization in DOD facilities [DE82-008108] p 7 N83-16925

- Modeling energy/economy interactions for conservation and renewable energy-policy analysis [DE82-009159] p 7 N83-16926

- Heat energy consumption and intermittent heating [PB82-255159] p 8 N83-16945

- Radon-daughter exposures in energy-efficient buildings [DE82-003711] p 9 N83-16964

- Symposium on Commercial Aviation Energy Conservation Strategies Papers and presentations [AD-A107106] p 11 N83-17455

- Potential fuel savings through improved airframe maintenance p 11 N83-17456

- Aircraft towing feasibility study p 11 N83-17458

- The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations --- (Los Angeles) p 11 N83-17459

- An overview of the DOT/FAA aviation energy conservation policy p 11 N83-17460

- Air traffic control Its effect on fuel conservation p 12 N83-17464

- Computerized engine and airplane performance monitoring programs p 12 N83-17465

- Sideslip indication system p 12 N83-17466

- Turbine engine fuel conservation by fan and compressor profile control p 12 N83-17467

- A practical economic criterion for fuel conservation p 12 N83-17468

- Residential end use demand modeling Improvements to the ORNL model [DE82-004925] p 13 N83-17750

- Residential-appliance load characteristics [DE82-012893] p 13 N83-17824

- Peak-resource estimation in New York State [DE82-005156] p 108 N83-18007

- Advisory Council on energy conservation Report to the Secretary of State for Energy [EP-49] p 14 N83-18018

Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 1 [BMFT-FB-T-82-151-VOL-1] p 15 N83-18026

Renewable energy system feasibility study [AD-A121252] p 15 N83-18035

Energy conservation in electrostatic fabric filtration of industrial dust [DE82-006897] p 15 N83-18036

The New England Energy Congress Project [DE82-005521] p 16 N83-18041

New priorities in energy-conservation research and development [DE82-005988] p 16 N83-18054

The comprehensive community energy management program. An evaluation [DE82-011552] p 17 N83-18060

Commercial building design and energy conservation. A preliminary assessment [DE82-008581] p 17 N83-18067

Energy considerations. Mobile homes in the south [DE82-009586] p 17 N83-18068

Development of residential-conservation-survey methodology for the US Air Force. Task 2 [DE82-009473] p 18 N83-18077

Impact of flywheel-energy-storage technology upon taxicab fleet operation in a large metropolitan city [DE82-002371] p 19 N83-18591

Energy and life-cycle cost analysis of a six-story office building [DE82-004840] p 20 N83-18963

Conceptual design of the 6 MW Mod-5A wind turbine generator p 173 N83-19271

Supersaturated homes in North America. A review and update [DE82-011565] p 21 N83-19290

Preliminary analysis of the state of the art of robotics and precision engineering and evaluation of potential for improved energy utilization in the pulp, paper, and related energy-consuming processes [DE83-001016] p 21 N83-19294

Development and implementation of dynamic methodologies for evaluating energy conservation strategies [PB82-240763] p 21 N83-19304

Development and implementation of dynamic methodologies for evaluating energy conservation strategies. Executive summary p 21 N83-19305

Strategies for energy conservation in small office buildings [PB82-245820] p 22 N83-19306

Swedish national and local government programs for conservation of energy in buildings [PB82-246752] p 22 N83-19307

Federal energy conservation programs. Perspectives from the public and private sectors. Volume 2. Public hearing, July 14 and 15, 1981, Washington, D.C. [PB82-238544] p 22 N83-19313

An overview of the Goldstone Energy Systems study p 24 N83-19780

Liquid fossil-fuel technology [DE83-002501] p 121 N83-19937

Energy-efficient alcohol-fuel production [DE82-011278] p 122 N83-19944

New design concepts for energy-conserving buildings. Results of a national competition among students in schools of architecture [DE82-013319] p 24 N83-19950

Bartlesville Energy Technology Center enhanced oil recovery project data base [DE82-012568] p 123 N83-20333

US solar and conservation technologies in international markets [GPO-99-627] p 25 N83-20369

Brazilian energy model [DE82-902461] p 26 N83-20378

Energy planning for development. Needs and approaches [DE82-014180] p 26 N83-20420

Potential benefits of R and D directed toward increasing the cost-effectiveness of energy use [DE83-013435] p 27 N83-20423

Introduction to the nonresidential buildings energy-consumption survey. 1979-1980 building characteristics, energy end use and fuel oil tank data. Public use data tapes, shoppers' guide [DE82-012522] p 27 N83-20424

Putting renewable energy to work in cities [DE82-016178] p 27 N83-20427

Energy-data validation. An overview and some concepts [DE82-020901] p 27 N83-20431

On-site fuel cell field test support program [PB83-121723] p 28 N83-20439

Solar-augmented applications in industry. Phase 2. Conceptual designs, volume 1 [PB83-102301] p 72 N83-20441

Review and evaluation of automotive fuel conservation technologies [PB83-101139] p 30 N83-20844

Review and evaluation of automotive fuel technologies. Volume 1. Summary [PB83-101147] p 30 N83-20845

The application of DOE-2 in the predesign phase of commercial-building design [DE82-014067] p 31 N83-21201

US heat-pump research and development projects [DE83-000943] p 31 N83-21536

South Carolina energy outlook [DE83-002121] p 32 N83-21561

Use of vegetation to ameliorate building microclimates. An assessment of energy-conservation potentials [DE82-013255] p 32 N83-21572

Enhancement of energy savings through accelerated implementation of high-performance forge furnaces [DE82-010913] p 32 N83-21578

Use of twin wells and water-source heat pumps for energy conservation in Louisiana [DE83-900349] p 32 N83-21610

Exterior insulating shutter final prototype design [DE83-004520] p 33 N83-21616

Summary of recommendations on basic research p 35 N83-22761

Energygrams. Brief descriptions of energy technology [DE83-001868] p 35 N83-22792

Perspective on our energy options [DE82-005828] p 36 N83-22802

First year's performance data of the NCSU solar energy and conservation house [DE83-004800] p 83 N83-22808

Investigation of attic insulation effectiveness using actual energy consumption data [DE83-000225] p 36 N83-22828

Maintaining automotive mobility. Using fuel economy and synthetic fuels to compete with OPEC oil [DE83-004873] p 37 N83-23245

ENERGY CONSUMPTION

Contemporary electric vehicle testing and evaluation p 3 A83-27160

R and D of energy saving and new energy utilization in Japanese marine engineering p 4 A83-27225

Energy projections to the year 2000, July 1982 update [DE82-022523] p 5 N83-16870

Energy audits at 48 hospitals [DE82-002814] p 5 N83-16884

Analysis of energy use at US institutional buildings [DE82-004670] p 6 N83-16886

Rymark 1, Rymark 2, and Rymark 3, Frederick, Maryland. Solar-energy-system performance evaluation, May 1981 through March 1982 [DE83-000067] p 57 N83-16890

Contemporary Systems, Inc., Walpole, New Hampshire. Solar-energy-system performance evaluation [DE83-000068] p 57 N83-16894

Energy plan, 1981 [DE82-902329] p 6 N83-16902

Heat energy consumption and intermittent heating [PB82-255159] p 8 N83-16945

Solar energy plant as a complement to a conventional heating system. Measurement of the storage and consumption of solar energy [PB82-255209] p 59 N83-16946

Residential end use demand modeling. Improvements to the ORNL model [DE82-004925] p 13 N83-17750

Digest of United Kingdom Energy Statistics, 1982 [ISBN-0-11-411124-3] p 14 N83-18019

The iron and steel industry. Energy consumption and conservation in the iron and steel industry [ENERGY-AUDIT-SER-16] p 14 N83-18020

Two global scenarios. The evolution of energy use and the economy to 2030 [IIASA-RR-81-35] p 14 N83-18021

Study based on ammonia/water solutions of a district heating transport system [BMFT-FB-T-82-188] p 186 N83-18033

Investigation of attic-insulation effectiveness using actual energy-consumption data [DE82-006822] p 17 N83-18055

Energy supply and demand in the Caribbean region, 1978-2000 [DE83-002312] p 18 N83-18080

US energy flow, 1981 [DE83-001579] p 18 N83-18081

Energy and life-cycle cost analysis of a six-story office building [DE82-004840] p 20 N83-18963

Overview of existing residential energy-efficiency rating systems and measuring tools [DE83-003148] p 20 N83-19289

Generic environmental and safety assessment of 5 battery energy-storage systems [DE82-902212] p 23 N83-19334

Technical documentation for the nonresidential-buildings energy-consumption survey, 1979-1980, building characteristics, energy end use and fuel oil tank data, public use data tapes. Users' guide [DE82-012523] p 24 N83-19957

Modeling water supply for the energy sector p 25 N83-20336

The role of business incentives in the development of renewable energy technologies [GPO-99-651] p 25 N83-20364

Brazilian energy model [DE82-902461] p 26 N83-20378

Materials for Coal Conversion and Utilization [DE82-013244] p 124 N83-20386

International energy indicators [DE82-012504] p 26 N83-20405

Small hydro-electric potential. West Poverty Bay region [DE82-905090] p 26 N83-20412

Potential benefits of R and D directed toward increasing the cost-effectiveness of energy use [DE83-013435] p 27 N83-20423

Introduction to the nonresidential buildings energy-consumption survey. 1979-1980 building characteristics, energy end use and fuel oil tank data. Public use data tapes, shoppers' guide [DE82-012522] p 27 N83-20424

Solar-augmented applications in industry. Phase 2. Conceptual designs, volume 1 [PB83-102301] p 72 N83-20441

Energy inputs and outputs of fuel-alcohol production, appendices G and H. Methanol from coal [DE83-000370] p 130 N83-21177

Energy inputs and outputs of fuel-alcohol production, appendices C through F. Methanol from cellulose [DE83-000369] p 130 N83-21178

Design and fabrication of a prototype system for photovoltaic residences in the southwest [DE83-003935] p 72 N83-21200

Federal applications for wind energy systems. A subcontract report [DE83-000306] p 31 N83-21543

Assessment of distributed photovoltaic electric-power systems [DE83-900531] p 75 N83-21558

South Carolina energy outlook [DE83-002121] p 32 N83-21561

Program listing for heat-pump. Seasonal-Performance Model (SPM) [DE83-002436] p 33 N83-21612

Motor-fuels for road vehicles [REPT-24] p 140 N83-22440

Ignition technique for conventional motors by high energy spark [INPE-2645-TDL/116] p 142 N83-22594

Role of energy resources in New Mexico [DE83-000663] p 34 N83-22673

Higher level of utilization of fuel-energy resources [BLL-M-26855-(5825 4)] p 35 N83-22737

Intermediate photovoltaic system application experiment. Operational performance report. Volume 5, for Beverly High School, Beverly, Mass. [DE82-012058] p 81 N83-22774

Role of water in energy development [DE82-011986] p 35 N83-22800

Investigation of attic insulation effectiveness using actual energy consumption data [DE83-000225] p 36 N83-22828

US energy for the rest of the century [PB83-114603] p 36 N83-22838

ENERGY CONVERSION

IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982. Volumes 1, 2, 3, 4 & 5 p 153 A83-27126

Joule heating effects in MHD generator boundary layers [NASA-CR-165127] p 161 A83-28956

The MOD-OA 200 kilowatt wind turbine generator design and analysis report [NASA-CR-165127] p 163 N83-16859

Energygrams. Brief descriptions of energy technology [DE82-003278] p 199 N83-16891

Energygrams. Brief descriptions of energy technology [DE82-003277] p 199 N83-16892

Performance and operational experience of a prototype binary geothermal power plant [DE82-006289] p 164 N83-16901

Biomass cogeneration. A business assessment [DE82-011773] p 101 N83-16928

Simulation of wind-speed time series for wind-energy conversion analysis [DE83-000043] p 165 N83-17026

- ARLIS 1.0 Linear investigation of aeroelastic systems in rotation [ISD-293] p 166 N83-17905
- Semiconductor photoelectrochemistry [NASA-TP-2088] p 167 N83-18024
- Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 2 [BMFT-FB-T-82-151-VOL-2] p 15 N83-18027
- Linear static and dynamic analysis for hinged rotor blades of 60 m span for a two bladed horizontal axis wind energy converter [ISD-291] p 167 N83-18030
- Pre-feasibility study for construction of a commercial coal hydrogenation plant [BMFT-FB-T-82-190] p 109 N83-18034
- Evaluation of the mathematical and economic basis for conversion processes in the LEAP energy-economy model [DE83-001706] p 167 N83-18079
- Design and standardization of meteorological measurements for wind energy converting systems [BMFT-FB-T-82-168] p 168 N83-18172
- Vehicle conversion to hybrid gasoline/alternative fuel operation [NASA-CR-169911] p 115 N83-19216
- Design and evaluation of low-cost stainless steel fiberglass foam blades for large wind driven generating systems [NASA-CR-165491] p 169 N83-19226
- Multiple and variable speed electrical generator systems for large wind turbines p 170 N83-19236
- Solar thermochemical energy conversion and transport [AD-A121318] p 64 N83-19276
- The socioeconomic impacts of synthetic fuels [GPO-98-702] p 24 N83-19923
- Gasification of land-based biomass [PB83-109918] p 122 N83-19946
- District heating and more-efficient buildings [DE81-025437] p 26 N83-20379
- Proceedings of the 1981 Symposium on Instrumentation and Control for Fossil-energy Processes [DE82-011999] p 124 N83-20406
- The plasmadynamics and ionization kinetics of thermionic energy conversion [DE82-012938] p 176 N83-20421
- Power plant concepts using new coal conversion technologies [BMFT-FB-T-82-031] p 131 N83-21506
- Energy from humid air [DE82-017121] p 180 N83-21601
- Electric power from orbit A critique of a satellite power system [DE83-002771] p 33 N83-21619
- Computer-aided industrial process design The ASPEN project [DE82-014469] p 181 N83-22484
- Study of solar array switching power management technology for space power system [NASA-CR-167890] p 81 N83-22756
- Conversion of coal to synthetic fuels p 144 N83-22768
- Intermediate photovoltaic system application experiment operational performance report Volume 5, for Beverly High School, Beverly, Mass [DE82-012058] p 81 N83-22774
- Role of water in energy development [DE82-011986] p 35 N83-22800
- Perspective on our energy options [DE82-005828] p 36 N83-22802
- ENERGY CONVERSION EFFICIENCY**
- Electrochemical solar cells using CdSe thin film electrodes p 37 N83-19885
- Practical limiting efficiencies for crystalline silicon solar cells p 37 N83-19893
- Origin of the difference in the open circuit voltage between p-n type and n-p type hydrogenated amorphous silicon solar cells p 37 N83-19991
- Amorphous silicon - A new semiconductor material for solar cells p 39 N83-21627
- Photoconductivity and photovoltaic effect in indium selenide p 39 N83-22337
- Area utilization efficiency of a sloping heliostat system for solar concentration p 39 N83-22618
- Photoelectrochemical behaviour of electrodeposited and pressure-sintered Bi₂S₃, Bi₂S₃-PbS and Bi₂S₃-Ag₂S semiconductor electrodes p 40 N83-22905
- Effect of an SiC layer on p-n amorphous silicon solar cells p 40 N83-22909
- A semiconductor-insulator-semiconductor CdO-SiO₂-Si solar cell p 41 N83-22912
- High efficiency p+/+n-n/+ back-surface field silicon solar cells with very large short-circuit current densities p 41 N83-22913
- Accuracy of analytical expressions for solar cell fill factors p 41 N83-22914
- MHD channel performance for potential early commercial MHD power plants p 151 N83-23134
- Influence of diffusion of hot carriers on collection efficiency of solar cells - a-Si:H p 42 N83-23665
- Convective losses from cavity solar receivers - Comparisons between analytical predictions and experimental results p 42 N83-23881
- Organic solar cells - A review p 44 N83-25449
- Preliminary test results for the small community solar power system [ASME PAPER 82-WA/SOL-30] p 44 N83-25687
- Regional thermal and electric energy output of salt-gradient solar ponds in the U.S. [ASME PAPER 82-WA/SOL-27] p 44 N83-25689
- Amorphous silicon photovoltaic modules p 45 N83-26064
- Radiative energy receiver for high performance energy conversion cycles p 46 N83-27138
- The relative attractiveness of electric and hybrid passenger cars p 3 N83-27159
- Assessment of phosphoric acid and trifluoromethane sulfonic acid fuel cells for vehicular powerplants p 154 N83-27162
- On insolation measurements using pyranometers and solar cell devices p 48 N83-27238
- Development of solar total energy system for industrial sectors p 48 N83-27244
- Space solar cell technology development - A perspective p 49 N83-27255
- Current developments in silicon space cells p 50 N83-27256
- Single and multijunction space solar cells grown by organometallic vapor phase epitaxy /OM-VPE/ p 50 N83-27260
- Stirling engines for solar power generation in the 50 to 500 kW range p 50 N83-27274
- Performance characteristics of wet and dry fluidynes --- Stirling cycle engines p 156 N83-27276
- A new, versatile Stirling energy conversion unit p 157 N83-27280
- A way to relax the dimensional tolerance requirements of clearance regenerators --- in small Stirling engine design p 158 N83-27286
- Direct-energy-conversion implications of space nuclear reactors p 159 N83-27297
- Thermionic converters for terrestrial applications p 159 N83-27299
- Large parabolic dish collectors with small gas-turbine, Stirling engine or photovoltaic power conversion systems p 160 N83-27329
- Factors affecting the efficiency of chemically deposited CdSe based photoelectrochemical cells p 54 N83-29514
- Influence of grain boundaries on solar cell performance [DE82-004662] p 56 N83-16881
- Performance of an experimental photovoltaic-powered house [DE82-000662] p 58 N83-16908
- A highly efficient collector for small solar energy installations [PB82-255191] p 60 N83-16948
- Chalcogenophosphate photoelectrodes [NASA-CASE-LAR-12958-1] p 60 N83-18025
- Data report for the Northeast Residential Experiment Station, October 1981 [DE82-007648] p 61 N83-18044
- Long-term energy capture and the effects of optimizing wind turbine operating strategies p 171 N83-19248
- Performance and load data from Mod-0A and Mod-1 wind turbine generators p 171 N83-19255
- Intermediate photovoltaic system application experiment operational performance report Volume 6 Beverly High School, Beverly, Mass [DE82-014710] p 69 N83-20391
- Wisconsin collector-efficiency study, phase two [DE82-013425] p 71 N83-20426
- Intermediate photovoltaic system application experiment operational performance report Volume 2 G N Wilcox Memorial Hospital, Kauai, Hawaii [DE83-002139] p 74 N83-21541
- Thermal-receiver designs for line-focus solar collectors [DE82-012067] p 82 N83-22777
- Photovoltaic cell and module status assessment Volume 1 Technology overview [DE83-900567] p 82 N83-22791
- ENERGY DISSIPATION**
- On the orientation precision of satellite solar power stations p 41 N83-23164
- Convective losses from cavity solar receivers - Comparisons between analytical predictions and experimental results p 42 N83-23881
- The iron and steel industry Energy consumption and conservation in the iron and steel industry [ENERGY-AUDIT-SER-16] p 14 N83-18020
- ENERGY OF FORMATION**
- Extraction of coal with solvents in liquid and supercritical state under nonhydrogenating and hydrogenating conditions [BMFT-FB-T-82-177] p 109 N83-18032
- ENERGY POLICY**
- Evaluation of solar reflective surfaces for dish concentrators p 48 N83-27237
- Critique of conceptual design for removal of sodium from lignite by ion exchange [DE82-010789] p 95 N83-16439
- Energy projections to the year 2000, July 1982 update [DE82-022523] p 5 N83-16870
- Game-theory approach to consumer incentives for solar energy [DE82-004501] p 56 N83-16882
- Energy plan, 1981 [DE82-002329] p 6 N83-16902
- Modeling energy/economy interactions for conservation and renewable energy-policy analysis [DE82-009159] p 7 N83-16926
- Biomass cogeneration A business assessment [DE82-011773] p 101 N83-16928
- Replacement of lumpy chrome ore by agglomerated ore concentrates and lowering of specific power consumption and improvement of Cr yield by means of improved slag composition in the production of HC ferrochrome [BMFT-FB-T-82-084] p 7 N83-16929
- Landfill gas to electricity demonstration project [PB82-255290] p 7 N83-16943
- Combustion of solvent-refined coal in a 100 HP firetube boiler [DE82-007670] p 103 N83-17640
- Coalging polymer demonstration project [DE82-007019] p 105 N83-17726
- H-Coal Pilot Plant Phase 2 Construction and Phase 3 Operation [DE82-005117] p 106 N83-17732
- Solvent-Refined-Coal (SRC) process [DE82-010061] p 107 N83-17743
- Advisory Council on energy conservation Report to the Secretary of State for Energy [EP-49] p 14 N83-18018
- The energy transition and the macroeconomy A framework for policy analysis [DE82-007839] p 16 N83-18039
- The New England Energy Congress Project [DE82-005521] p 16 N83-18041
- Analytical and policy issues in energy economics Uses of the FRS data base [DE82-004258] p 16 N83-18051
- The comprehensive community energy management program An evaluation [DE82-011552] p 17 N83-18060
- Energy development on Native American lands Resources and attitudes An interpretive report on two major Indian conferences of 1980 [DE82-009539] p 17 N83-18076
- Ultrasonically enhanced size reduction of coal [DE82-008679] p 113 N83-18416
- Program planning for future improvement in managing ORNL's radioactive wastes [DE82-007721] p 19 N83-18467
- Optical properties of sputtered Si:H [DE82-007072] p 62 N83-18491
- Program management plan for the conduct of a research, development and demonstration program for improving the safety of nuclear powerplants [DE82-008776] p 19 N83-18555
- Future analysis, forecasting and planning for telecommunications, energy and public utilities [RAND-P-6796] p 20 N83-18978
- Critical need for energy research and development The role of the Midwest Research Laboratories [GPO-11-308] p 169 N83-19229
- Large Horizontal-Axis Wind Turbines [NASA-CP-2230] p 169 N83-19231
- The response of a 38m horizontal axis teetered rotor to yaw p 169 N83-19232
- Fixed pitch rotor performance of large horizontal axis wind turbines p 169 N83-19233
- Stall induced instability of a teetered rotor p 169 N83-19234
- Free yaw performance of the Mod-0 large horizontal axis 100 kW wind turbine p 170 N83-19235
- Putting wind resource atlases to use p 115 N83-19237
- Approaches to wind resource verification p 116 N83-19238
- Assessing the representativeness of wind data for wind turbine site evaluation p 116 N83-19239
- Wind turbine siting A summary of the state of the art p 116 N83-19240

- National implications of solar futures A TASE project report
[DE82-005122] p 64 N83-19281
- Development and implementation of dynamic methodologies for evaluating energy conservation strategies
[PB82-240763] p 21 N83-19304
- Development and implementation of dynamic methodologies for evaluating energy conservation strategies Executive summary
[PB82-240771] p 21 N83-19305
- Swedish national and local government programs for conservation of energy in buildings
[PB82-246752] p 22 N83-19307
- Federal energy conservation programs Perspectives from the public and private sectors Volume 2 Public hearing, July 14 and 15, 1981, Washington, D.C.
[PB82-238544] p 22 N83-19313
- New design concepts for energy-conserving buildings Results of a national competition among students in schools of architecture
[DE82-013319] p 24 N83-19950
- Analysis and design of residential load centers Volume 2 Appendices
[DE82-014253] p 24 N83-19956
- Modeling water supply for the energy sector
p 25 N83-20336
- An Energy Crisis Management Simulation for the State of California
[RAND/R-2899-CEC] p 25 N83-20363
- Introduction to the nonresidential buildings energy-consumption survey 1979-1980 building characteristics, energy end use and fuel oil tank data Public use data tapes, shoppers' guide
[DE82-012522] p 27 N83-20424
- Putting renewable energy to work in cities
[DE82-016178] p 27 N83-20427
- World oil
[DE82-906440] p 27 N83-20433
- Partial liquefaction of coal by flash hydrolysis
[DE83-001145] p 126 N83-21077
- Catalytic coal liquefaction
[DE83-001098] p 127 N83-21078
- Waste lubricating oil An annotated review, 1982 revision
[DE83-001439] p 30 N83-21156
- Nuclear power compared with other energy sources A brief comparative study of some of the risks
[BLL-CE-TRANS-7745-(9022 09)] p 31 N83-21501
- Future landscapes of the Colorado plateau Impacts of energy development
[DE83-900473] p 34 N83-21666
- Coal-liquefaction-plant fractionation-column corrosion-coupon studies
[DE82-007469] p 139 N83-22360
- Fuel supply and distribution Fixed base operation
p 141 N83-22449
- The HFEM monitoring of coal gasification Rawlins, Wyoming
[DE82-013801] p 142 N83-22466
- Cartographic evaluation of environmental-management strategies
[DE82-009828] p 35 N83-22702
- Industry/Government Forum on Recent Policy and Budget Changes in the DOE Solar-Thermal Program
[DE82-012511] p 36 N83-22801
- Perspective on our energy options
[DE82-005828] p 36 N83-22802
- Underground energy-storage program overview
[DE83-002059] p 198 N83-22806
- Hydrogen use in a rural Alaskan community
[DE83-000568] p 90 N83-22813
- The engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc. at Thibodaux, Louisiana Attachment A Volume 2 Definition of facilities and scope of work for an ethanol facility to be located at Thibodaux, Louisiana
[DE83-001165] p 147 N83-22829
- Gasoline shortfall management
p 148 N83-23213
- ENERGY REQUIREMENTS**
- Energy plan, 1981
[DE82-902329] p 6 N83-16902
- Residential-appliance load characteristics
[DE82-012883] p 13 N83-17824
- Peat-resource estimation in New York State
[DE82-005156] p 108 N83-18007
- Digest of United Kingdom Energy Statistics, 1982
[ISBN-0-11-41124-3] p 14 N83-18019
- Two global scenarios The evolution of energy use and the economy to 2030
[IIASA-RR-81-35] p 14 N83-18021
- Pacific Northwest biomass as an energy resource
[DE82-005804] p 110 N83-18047
- Energy supply and demand in the Caribbean region, 1978-2000
[DE83-002312] p 18 N83-18080
- Research on spacecraft electrical power conversion
[NASA-CR-169974] p 20 N83-19227
- Transportation network models for energy supply analysis Volume 3 Transportation network model user's guide and documentation
[DE82-903079] p 187 N83-20400
- Energy planning for development Needs and approaches
[DE82-014180] p 26 N83-20420
- Putting renewable energy to work in cities
[DE82-016178] p 27 N83-20427
- Route profile analysis to determine suitability of electric postal-delivery vehicles
[DE82-012216] p 29 N83-20842
- Seminar on Use of High Strength Deformed Bars
[PB83-122580] p 34 N83-22486
- US energy for the rest of the century
[PB83-114603] p 36 N83-22838
- ENERGY SOURCES**
- Main advances and needs on the study of geothermal resources in Chile by using remote sensing techniques
p 91 N83-21946
- Ocean thermal-energy conversion
p 152 N83-25125
- Miami International Conference on Alternative Energy Sources, 5th, Miami Beach, FL, December 13-15, 1982, Proceedings of Condensed Papers p 3 N83-25575
- Wave model A numerical model for the frictional absorption of water waves
[PB83-100792] p 122 N83-20073
- Energy planning for development Needs and approaches
[DE82-014180] p 26 N83-20420
- Utilization of secondary energy resources at Magnitogorsk Metallurgical Combine
[BLL-M-26856-(5828 4)] p 131 N83-21502
- ENERGY STORAGE**
- Storing energy in metal hydrides - A review of the physical metallurgy
p 188 N83-21562
- Study on composite flywheels for energy storage
p 188 N83-22701
- Stored chemical energy propulsion system for underwater applications
[AIAA PAPER 81-1601] p 188 N83-23132
- Configuration selection study for isolated loads --- using parabolic dish modules to supply power for MX shelters
p 41 N83-23137
- Design flexibility of redox flow systems --- for energy storage applications
p 189 N83-27177
- Evaluation of solar reflective surfaces for dish concentrators
p 48 N83-27237
- Compression molded energy storage flywheels
p 189 N83-27303
- The use of mechanical energy storage in an unconventional, rough terrain vehicle
p 190 N83-27309
- Factors affecting storage of compressed air in solution mined salt cavities
p 191 N83-27311
- Increasing summer peak power with aquifer storage
p 191 N83-27313
- Reversible chemical reactions for energy storage in a large-scale heat utility
p 51 N83-27315
- Modeling and evaluation of designs for solid hydrogen storage beds
p 87 N83-27333
- Theory of the computer code RET 1 for the calculation of space-time dependent temperature and composition properties of metal hydride hydrogen storage beds
p 88 N83-27337
- Porous metal hydride compacts - Preparation, properties and use
p 88 N83-27338
- Magnesium for hydrogen storage
p 88 N83-27339
- A system of hydrogen-powered vehicles with liquid organic hydrides
p 88 N83-27340
- Photochemical storage potential of azobenzenes
p 191 N83-28941
- Redox ion flow cell for solar energy storage
p 54 N83-29407
- Design and construction of a demonstration residence utilizing natural thermal storage
[DE82-005508] p 5 N83-16569
- Bellingham Phase 3, Engineering and technology development for a hot-water district-heating system employing thermal-energy storage
[DE82-000106] p 192 N83-16862
- Compressed-air energy storage preliminary design and site development program in an aquifer Volume 3, part 1 Site Selection study
p 192 N83-16869
- Energygrams Brief descriptions of energy technology
[DE82-003278] p 199 N83-16891
- Energygrams Brief descriptions of energy technology
[DE82-003277] p 199 N83-16892
- Investigation of intercalated compounds for photoelectrochemical energy storage
[DE83-000543] p 192 N83-16899
- Development of advanced batteries for utility application
[DE82-906459] p 193 N83-16918
- Practical and theoretical analysis of continuous selection of temperature layers in a hot tank by an experimental tank and a simulation model
[BMFT-FB-T-82-171] p 13 N83-17842
- Compressed-air energy storage Preliminary design and site-development program in an aquifer Volume 3 Site-selection study, part 2
[DE83-001252] p 194 N83-18074
- Impact of flywheel-energy-storage technology upon taxicab fleet operation in a large metropolitan city
[DE82-002371] p 194 N83-18591
- Physical properties data compilations relevant to energy storage Part 5 Mechanical properties data on alloys for use in flywheels
[PB82-232919] p 194 N83-18904
- Solar energy systems Standards for screening plastic containment materials
[PB82-242454] p 62 N83-18921
- Repetitive switching for inductive energy storage
[AD-A121029] p 194 N83-19277
- An evaluation of hydrated calcium aluminate compounds as energy storage media
[PB82-249921] p 194 N83-19308
- Genetic environmental and safety assessment of 5 battery energy-storage systems
[DE82-902212] p 23 N83-19334
- Study to establish cost predictions for the production of Redox chemicals
[NASA-CR-167882] p 194 N83-20359
- Analytical and experimental investigations of sodium heat pipes and thermal energy storage systems
[AD-A122093] p 195 N83-20375
- CAESCAP A computer code for compressed-air energy-storage-plant cycle analysis
[DE83-003146] p 196 N83-21528
- A 10-MWe solar-thermal central-receiver pilot plant Solar facilities design integration Plant operating/training manual (RADL-Item 2-36)
[DE83-001670] p 75 N83-21551
- Energy-storage-flywheel housing-design-concept development
[DE82-014494] p 196 N83-21574
- Preliminary design study of compressed-air energy storage in a salt dome Volume 6 CAES plant design
[DE82-014355] p 196 N83-21580
- Superconductive energy storage
[DE83-002270] p 196 N83-21624
- Analytical modeling of a hydraulically-compensated compressed-air energy-storage system
[DE83-005708] p 197 N83-21640
- Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model
[DE83-004004] p 197 N83-22758
- Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, Part 1 Turbomachinery design
[DE83-004005] p 197 N83-22759
- Parametric investigations and other related studies of energy storage type capacitors
[DE83-003426] p 197 N83-22785
- Issues affecting storage of compressed air in solution-mined salt cavities
[DE83-002017] p 197 N83-22804
- Aquifer compressed-air field experiment at Pittsfield, Illinois
[DE83-002057] p 198 N83-22805
- Geotechnical basis for underground energy storage in hard rock
[DE82-903307] p 198 N83-22836
- Proceedings of the Mechanical, Magnetic and Underground Energy-Storage 1981 Annual Contractors' Review
[DE82-008853] p 198 N83-22837
- Study of vacuum systems for a heat engine/flywheel automotive propulsion system
[DE83-002284] p 198 N83-23244
- ENERGY TECHNOLOGY**
- Sunshine project solar photovoltaic program and recent activities in Japan
p 37 N83-20137
- Status of photovoltaic materials and process technologies
p 38 N83-20435
- Load following impacts of a large wind farm on an interconnected electric utility system
p 151 N83-22675
- Present status of R&D for hydrogen production from water in Japan
p 86 N83-23701
- Progress in photovoltaic energy conversion
p 42 N83-23859
- Advances in wind energy technology
[DGLR PAPER 82-082] p 151 N83-24194

Electricity from wind - A survey of the state of the art and future prospects for research and development [DGLR PAPER 82-081] p 152 A83-24202

International Conference on Future Energy Concepts, 3rd, London, England, January 27-30, 1981, Proceedings p 199 A83-24975

Solar technology - A whether report p 43 A83-25124

Ocean thermal-energy conversion p 152 A83-25125

Can industry afford solar energy p 44 A83-25144

Metal-insulator-semiconductor silicon solar cells p 44 A83-25447

Miami International Conference on Alternative Energy Sources, 5th, Miami Beach, FL, December 13-15, 1982, Proceedings of Condensed Papers p 3 A83-25575

Size effects in DAWT innovative wind energy system design [ASME PAPER 82-WA/SOL-20] p 153 A83-25688

New materials for solar cells - Tandem cells p 45 A83-26882

IECEC '82, Proceedings of the Seventeenth Intersociety Energy Conversion Engineering Conference, Los Angeles, CA, August 8-12, 1982 Volumes 1, 2, 3, 4 & 5 p 153 A83-27126

Energy utilization of electric and hybrid vehicles p 188 A83-27164

Sodium-sulfur battery program in Japan p 189 A83-27175

Acid fuel cell technologies for vehicular power plants p 154 A83-27185

Metal hydride heat pump p 3 A83-27211

Thermoelectric conversion for space nuclear power p 155 A83-27222

Marine power - Accomplishments of the 1970s p 155 A83-27223

Some ocean engineering considerations in the design of OTEC plants p 155 A83-27224

Developments in tidal power p 155 A83-27226

OTEC plants for today's island market p 156 A83-27227

Advanced component research in the solar thermal program p 47 A83-27233

National project of new energy development in Japan p 48 A83-27243

Development of solar total energy system for industrial sectors p 48 A83-27244

Stirling engines for solar power generation in the 50 to 500 kW range p 50 A83-27274

Further development of the fluidyne liquid-piston engine p 156 A83-27275

Design of hydraulic output unit for 15 kW free-piston Stirling engine p 157 A83-27277

Increasing summer peak power with aquifer storage p 191 A83-27313

High-temperature molten salt solar thermal systems p 51 A83-27317

The NASA program in Space Energy Conversion Research and Technology p 160 A83-27326

Augmentation of power in slow-running vertical-axis wind rotors using multiple vanes p 160 A83-27868

Optimization of pulling conditions by electronic bombardment of polycrystalline silicon ribbons for solar cells - French thesis p 55 A83-29946

Penetration for four solar technologies in electric utilities and the environmental benefits p 59 A83-16927

Heating of domestic water by waste heat recovery from household refrigerating equipment [BMFT-FB-T-82-156] p 7 A83-16930

West Europe report Science and technology, no 134 [JPRS-82686] p 199 A83-17761

First results, problems of French deep gasification program p 107 A83-17765

Rationale for advances in the technology of IC engines p 14 A83-17886

Recovery of minerals from US coals p 108 A83-18010

Digest of United Kingdom Energy Statistics, 1982 [ISBN-0-11-411124-3] p 14 A83-18019

Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 1 [BMFT-FB-T-82-151-VOL-1] p 15 A83-18026

Aeroelastic stability and dynamic response analysis of the LDB-125 vertical axis wind turbine [FFA-TN-1982-19] p 167 A83-18028

Pre-feasibility study for construction of a commercial coal hydrogenation plant [BMFT-FB-T-82-190] p 109 A83-18034

A data-gathering method for use in modeling energy research, development and demonstration programs [DE82-006153] p 16 A83-18040

The 5 MW for solar-chemistry development [DE82-002064] p 60 A83-18043

High-temperature composite latent/sensible heat storage [DE82-010396] p 62 A83-18063

A preliminary plan for the development of geothermal energy in the town of Hawthorne, Nevada [DE82-007594] p 17 A83-18065

Fossil energy program p 111 A83-18082

Fossil-energy program [DE82-007502] p 111 A83-18083

Perspectives in non-fuel minerals p 112 A83-18143

Decision framework for technology choice Volume 1

A case study of one utility's coal-nuclear choice [DE82-902213] p 113 A83-18554

External combustion steam injected gas turbine [DE82-019862] p 168 A83-19102

Engineering the Future for the Benefit of Mankind, volume 2 [PB82-225491] p 24 A83-19634

Activities report in space research in the Federal Republic of Germany p 200 A83-19702

Publications in life sciences synthetic fuels of Oak Ridge National Laboratory p 122 A83-19945

Bartlesville Energy Technology Center enhanced oil recovery project data base [DE82-012568] p 123 A83-20333

Renewable energy in the eighties Needs for further R and D [GPO-99-663] p 25 A83-20367

High-cycle-life, high-energy-density nickel-zinc batteries [DE82-012896] p 195 A83-20376

Fossil-energy [DE83-003817] p 124 A83-20383

Intermediate photovoltaic system application experiment operational performance report Volume 6 Beverly High School, Beverly, Mass [DE82-014710] p 69 A83-20391

Solar electric technologies Methods of electric utility value analysis [DE82-014285] p 71 A83-20409

Assessment of the basic energy sciences program Volume 2 Appendices [DE82-013245] p 26 A83-20419

Energy planning for development Needs and approaches [DE82-014180] p 26 A83-20420

Energy-data validation An overview and some concepts [DE82-020901] p 27 A83-20431

Energy efficient industrial technology in Europe A compendium [PB83-102327] p 28 A83-20442

Energy data base guide to abstracting and indexing [DE82-005748] p 200 A83-20821

Assessment of research directions for high-voltage direct-current power systems p 177 A83-21247

Fossil energy materials program plan for fiscal years 1982 through 1986 [DE83-004237] p 131 A83-21519

Future landscapes of the Colorado plateau Impacts of energy development p 34 A83-21666

Federal Technology Catalog 1982 Summaries of practical technology [PB83-121533] p 200 A83-22480

Higher level of utilization of fuel-energy resources [BLL-M-26855-(5825 4)] p 35 A83-22737

Intermediate photovoltaic system application experiment operational performance report Volume 5, for Beverly High School, Beverly, Mass [DE82-012058] p 81 A83-22774

Coordination of the onsite fuel cell program [PB83-119545] p 184 A83-22839

Biostatistics and health impacts of energy technologies p 36 A83-22962

Research in transportation engineering in the United States p 37 A83-23208

ENERGY TRANSFER

Light transport in planar luminescent solar concentrators - The role of DCM self-absorption --- 4-dicyano-methylene-2-methyl-6-p-dimethyl-H-pyran p 39 A83-22619

Energy-transmission-system heat losses [DE83-003628] p 187 A83-22786

ENGINE DESIGN

Stored chemical energy propulsion system for underwater applications [AIAA PAPER 81-1601] p 188 A83-23132

Characteristics of a closed Brayton cycle piston engine p 151 A83-23135

PW 4000 - A radically new jet engine being developed in the USA p 1 A83-23239

A system of criteria for evaluating the energy efficiency of an engine at the state of technical proposals p 1 A83-23437

Control design for a wind turbine-generator using output feedback p 152 A83-24721

An approach to helicopter power selection p 3 A83-24828

Rotary engines p 152 A83-25140

A concept of heat pipe engine p 154 A83-27208

Whence Stirling engines --- auto and air applications p 156 A83-27265

Further development of the fluidyne liquid-piston engine p 156 A83-27275

Design of hydraulic output unit for 15 kW free-piston Stirling engine p 157 A83-27277

A new, versatile Stirling energy conversion unit p 157 A83-27280

An isothermal second-order Ringbom-Stirling engine computer program p 157 A83-27281

50 kW Stirling engine p 157 A83-27282

Design and experiences with a laboratory Stirling cycle machine p 157 A83-27284

U K Consortium Stirling engine programme p 157 A83-27285

A way to relax the dimensional tolerance requirements of clearance regenerators --- in small Stirling engine design p 158 A83-27286

Improved Stirling engine performance using jet impingement p 158 A83-27288

Back-to-back test for determining the pumping losses in a Stirling cycle machine p 158 A83-27290

Effects of displacer seal clearance on free-piston Stirling engine performance p 158 A83-27295

A study on two-phase, two-component Stirling engine p 160 A83-27328

18.1 pressure ratio axial/centrifugal compressor demonstration program p 161 A83-29013

Energy efficient engine Fan test hardware detailed design report [NASA-CR-165148] p 4 A83-16341

Supercharging with Compress p 168 A83-18940

The spark-ignition aircraft piston engine of the future p 141 A83-22450

Design of hydraulic output Stirling engine [NASA-CR-167976] p 181 A83-22739

ENGINE PARTS

Manufacture and testing of fibre composite rotor components /Fibre composite flywheel development program for road vehicle applications/ p 190 A83-27308

Advanced Gas Turbine (AGT) powertrain system development for automotive applications [NASA-CR-167983] p 166 A83-17424

ENGINE TESTS

Performance characteristics of wet and dry fluidynes --- Stirling cycle engines p 156 A83-27276

50 kW Stirling engine p 157 A83-27282

Design and experiences with a laboratory Stirling cycle machine p 157 A83-27284

U K Consortium Stirling engine programme p 157 A83-27285

Development of a Stirling engine rod seal p 158 A83-27294

Effects of displacer seal clearance on free-piston Stirling engine performance p 158 A83-27295

18.1 pressure ratio axial/centrifugal compressor demonstration program p 161 A83-29013

Refining studies and engine testing of alternative highway-transportation fuels Identification and evaluation of optimized alternative fuels p 129 A83-21172

ENGINEERING MANAGEMENT

Engineering the Future for the Benefit of Mankind, volume 2 [PB82-225491] p 24 A83-19634

ENGINES

Whither Stirling engines --- principles and applications p 156 A83-27266

ENTRAINMENT

Heavy Gas Dispersal [VKI-LS-1982-03] p 200 A83-19316

Identification of problem areas related to the dispersion of heavy gases p 200 A83-19318

ENVIRONMENT EFFECTS

The environmental impact of the use of large wind turbines p 4 A83-27867

Using peat for energy Potential environmental restraints Overview p 5 A83-16876

Penetration for four solar technologies in electric utilities and the environmental benefits [DE82-010864] p 59 A83-16927

Ocean Thermal Energy Conversion Environmental effects assessment program plan, 1981 - 1985 [PB82-258047] p 165 A83-16941

- Programmatic environmental overview Biomass fuels program
[DE82-906065] p 101 N83-16975
- Environmetrics of synfuels Part 4 Project Results Tracking System (PRTS)
[DE82-011444] p 10 N83-15977
- Development of statistical databases for toxicological studies
[DE82-005196] p 10 N83-17067
- EDS coal-liquefaction process development Phase 5 EDS environmental program
[DE82-005641] p 12 N83-17673
- The Second Conference on the Environmental Chemistry of Hydrazine Fuels
[AD-A121324] p 13 N83-17731
- Western oil-shale development, a technology assessment. Volume 6 Oil-shale development in the Piceance Creek Basin and potential water-quality changes
[DE82-005659] p 108 N83-18009
- Pre-feasibility study for construction of a commercial coal hydrogenation plant
[BMFT-FB-T-82-190] p 109 N83-18034
- Environmental impacts of undergrounding high-voltage transmission Health and safety
[DE82-010108] p 186 N83-18102
- Site selection and characterization for an underground coal gasification test in Washington State Volume 2 Project details
[DE82-010948] p 19 N83-18117
- Perspectives in non-fuel minerals p 112 N83-18143
- Environmental data for sites in the National Solar Data Network
[DE82-007055] p 64 N83-19280
- Analysis of environmental issues related to small-scale hydroelectric development 6 Dissolved oxygen concentrations below operating dams
[DE82-007127] p 22 N83-19329
- Publications in life sciences synthetic fuels of Oak Ridge National Laboratory
[DE83-001701] p 122 N83-19945
- Effect of low-proof alcohol fumigation-fueling on crankcase oil dilution in a diesel-cycle engine
[DE83-002976] p 122 N83-20171
- Environmental quality research Fate of toxic jet fuel components in aquatic systems
[AD-A122548] p 30 N83-21168
- Alaskan coal Resources and developmental constraints
[DE83-000860] p 130 N83-21494
- Preliminary design study of compressed-air energy storage in a salt dome Volume 6 CAES plant design
[DE82-014355] p 196 N83-21580
- Intermediate photovoltaic system application experiment operational performance report for CDC Light Manufacturing Building, San Bernardino, California
[DE83-002529] p 78 N83-21605
- Intermediate photovoltaic system application experiment operational performance report for Oklahoma Center for Science and Arts for June, July, and August 1982
[DE83-003668] p 78 N83-21606
- Preliminary evaluation of environmental issues on the use of peat as an energy source
[DE83-000820] p 34 N83-21651
- Future landscapes of the Colorado plateau Impacts of energy development
[DE83-900473] p 34 N83-21666
- Environmental effects of solar-thermal power systems Ecological observations during early testing of the Barstow 10-MWe pilot STPS
[DE83-004454] p 85 N83-22856
- Examination of tidal flats Volume 3 Evaluation methodology
[PB83-131805] p 148 N83-22949
- ENVIRONMENT MANAGEMENT**
Preliminary evaluation of environmental issues on the use of peat as an energy source
[DE83-000820] p 34 N83-21651
- ENVIRONMENT POLLUTION**
Ground contamination by fuel jettisoned from aircraft in flight p 1 A83-24041
- Programmatic environmental overview Biomass fuels program
[DE82-906065] p 101 N83-16975
- EDS coal-liquefaction process development Phase 5 EDS environmental program
[DE82-005641] p 12 N83-17673
- Geotoxic materials in the surface environment
[DE82-005855] p 23 N83-19333
- Short-Term Bioassays in the Analysis of Complex Environmental Mixtures 2
[PB82-233172] p 23 N83-19420
- Pressing problems of radioecology in light of solving atomic energy problems p 36 N83-22977
- ENVIRONMENT PROTECTION**
Engineering the Future for the Benefit of Mankind, volume 2
[PB82-225491] p 24 N83-19634
- Future landscapes of the Colorado plateau Impacts of energy development
[DE83-900473] p 34 N83-21666
- ENVIRONMENT SIMULATION**
The simulation of global radiation p 37 A83-20139
- ENVIRONMENTAL CHEMISTRY**
The Second Conference on the Environmental Chemistry of Hydrazine Fuels
[AD-A121324] p 13 N83-17731
- ENVIRONMENTAL CONTROL**
Fossil energy program
[DE82-007496] p 111 N83-18082
- ENVIRONMENTAL MONITORING**
Utility experience with two demonstration wind turbine generators p 173 N83-19266
- Workshop report on Basic Research in Organic Geochemistry Applied to National Energy Needs
[DE82-007074] p 144 N83-22760
- Utilization of oil shales and basic research in organic geochemistry p 144 N83-22766
- ENVIRONMENTAL QUALITY**
Salt gradient solar pond development
[DE82-020630] p 58 N83-16916
- Assessment of battery buses and battery technology
[PB82-260019] p 11 N83-17428
- ENVIRONMENTAL TESTS**
Convective heat losses from flat-plate solar collectors in turbulent winds p 43 A83-23883
- Amorphous silicon photovoltaic modules p 45 A83-26064
- EPOXY MATRIX COMPOSITES**
Compression molded energy storage flywheels
[DE83-002730] p 189 A83-27303
- Low-cost composite blades for the Mod-OA wind turbines p 170 N83-19242
- Fiberglass composite blades for the 4 MW - WTS-4 wind turbine p 170 N83-19243
- EPOXY RESINS**
Construction of low-cost, Mod-OA wood composite wind turbine blades
[NASA-TM-83046] p 163 N83-16857
- EQUIPMENT SPECIFICATIONS**
The engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc at Thibodaux, Louisiana Attachment A Volume 2 Definition of facilities and scope of work for an ethanol facility to be located at Thibodaux, Louisiana
[DE83-001165] p 147 N83-22829
- EROSION**
High temperature erosion and erosion-hot corrosion of superalloys and coatings p 91 A83-21458
- A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas
[DE83-004095] p 135 N83-21686
- ERROR ANALYSIS**
Energy-data validation An overview and some concepts
[DE82-020901] p 27 N83-20431
- ERRORS**
Potential errors in using one anemometer to characterize the wind power over an entire rotor disk
[DE83-900473] p 171 N83-19254
- ESTIMATES**
Estimating pollutant exposures from coal fired power plants in a rural region
[DE82-008136] p 19 N83-18109
- Energy-data validation An overview and some concepts
[DE82-020901] p 27 N83-20431
- Energy inputs and outputs of fuel-alcohol production, appendices C through F Methanol from cellulose
[DE83-000369] p 130 N83-21178
- A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas
[DE83-004095] p 135 N83-21686
- Performance optimization of the ASR optical module
[DE83-004477] p 82 N83-22797
- ETCHING**
Developments and applications of tantalum thin films and hybrid technology
[BMFT-FB-T-82-173] p 199 N83-17686
- ETHYL ALCOHOL**
Design, construction, operation and costs of a modern small-scale fuel-alcohol plant
[DE82-011019] p 107 N83-17754
- Demonstration of modification of a gasoline spark-ignited engine to permit using ethanol as a fuel
[DE83-001384] p 114 N83-19101
- Energy inputs and outputs of fuel-alcohol production, summary volume
[DE83-000367] p 129 N83-21174
- Energy inputs and outputs of fuel-alcohol production Appendices A and B, ethanol from grain
[DE83-000368] p 129 N83-21175
- Technical/commercial feasibility study of the production of fuel-grade ethanol from corn
100-million-gallon-per-year production facility in Myrtle Grove, Louisiana Volume 1 Executive summary
[DE83-000777] p 132 N83-21531
- Technical/commercial feasibility study of the production of fuel-grade ethanol from corn
100-million-gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000776] p 132 N83-21532
- Technical/commercial feasibility study of the production of fuel-grade ethanol from corn
100-million-gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000775] p 132 N83-21533
- Technical/commercial feasibility study of the production of fuel-grade ethanol from corn
100-million-gallon-per-year production facility in Myrtle Grove, Louisiana Volume 5 Appendices
[DE83-000773] p 133 N83-21534
- Technical/commercial feasibility study of the production of fuel-grade ethanol from corn
100-million-gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000774] p 133 N83-21535
- Alternative engine fuels Educational demonstration project
[DE83-004579] p 141 N83-22462
- Ethanol production in small- to medium-size facilities
[DE83-900875] p 146 N83-22807
- The engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc at Thibodaux, Louisiana Attachment A Volume 2 Definition of facilities and scope of work for an ethanol facility to be located at Thibodaux, Louisiana
[DE83-001165] p 147 N83-22829
- EUROPEAN AIRBUS**
West Europe report Science and technology, no 133
[JPRS-82608] p 89 N83-17757
- EVALUATION**
Assessing the representativeness of wind data for wind turbine site evaluation p 116 N83-19239
- Wind turbine siting A summary of the state of the art p 116 N83-19240
- EXHAUST EMISSION**
Radiation and smoke from the gas turbine combustor using heavy fuels p 92 A83-23877
- Possibilities of improving exhaust emissions and energy consumption in mixed hydrogen-gasoline operation
[DE83-002734] p 87 A83-27334
- Emulsified fuel testing in a medium speed diesel engine
[PB82-250697] p 98 N83-16564
- Penetration and air-emission-reduction benefits of solar technologies in the electric utilities
[DE82-002637] p 9 N83-16971
- Alkali-metal-vapor removal from pressurized fluidized-bed combustor flue gas
[DE82-008088] p 10 N83-16976
- Assessment of battery buses and battery technology
[PB82-260019] p 11 N83-17428
- Diesel Emissions Symposium Proceedings
[PB82-244013] p 23 N83-19462
- Diesel technology
[GPO-99-748] p 25 N83-20151
- Costs to reduce sulfur dioxide emissions
[DE82-013309] p 28 N83-20451
- A study of emissions from light duty vehicles in San Antonio, Texas, year 2
[PB83-124743] p 36 N83-22867
- Characterization of exhaust emissions from methanol- and gasoline-fueled automobiles
[PB83-116830] p 149 N83-23249
- EXHAUST GASES**
Air traffic control Its effect on fuel conservation p 12 N83-17464
- Fiat researchers study ceramics applications in diesels
[DE83-001776] p 199 N83-17760
- Supercharging with Comrex p 168 N83-18940
- Review of hot-gas-desulfurization simulation models
[DE82-016265] p 138 N83-22356
- Methanol production from fermentor off-gases
[DE83-005011] p 145 N83-22793
- EXHAUST SYSTEMS**
Construction and operation of a central heating plant prototype heated by coal dust corresponding to the Schoppe system
[BMFT-FB-T-82-176] p 109 N83-18031
- EXPANDABLE STRUCTURES**
High production shuttle car system for coal mines
[NASA-CASE-NPO-15949-1] p 187 N83-20155

EXPANSION

- Energy from humid air
[DE82-017121] p 180 N83-21601

EXPERIMENT DESIGN

- Study of psychophysiological distinctions of primates using delayed reaction test p 85 N83-26442

EXPERIMENTAL BREEDER REACTOR 2

- Development of high-temperature liquid metal heat pipes for isothermal irradiation assemblies -- for in-pile tests of UO₂ space reactor fuel configurations p 185 A83-27129

EXPERIMENTATION

- Recent flame-propagation experiments at LLNL within the liquefied gaseous-fuels spill-safety program
[DE82-010729] p 103 N83-17651

EXPLORATION

- Application of energy dispersive X-ray fluorescence, ion sensitive electrodes and instrumental neutron activation in geochemical prospecting
[BMFT-FB-T-82-152] p 111 N83-18123
- National forecast for geothermal resource exploration and development with techniques for policy analysis and resource assessment
[DE82-014641] p 133 N83-21588

EXPLOSIVE FORMING

- Stratigraphic variations in oil-shale fracture properties
[DE82-021088] p 136 N83-21702

EXPONENTIAL FUNCTIONS

- Exponential growth and atmospheric carbon dioxide p 2 A83-24255

EXTRACTION

- Metal recovery from eastern oil shale
[DE82-004052] p 109 N83-18016
- Extraction of coal with solvents in liquid and supercritical state under nonhydrogenating and hydrogenating conditions
[BMFT-FB-T-82-177] p 109 N83-18032
- Liquid fossil-fuel technology
[DE83-002501] p 121 N83-19937
- Exploitation deliberations p 144 N83-22763

F**FABRICATION**

- Optimization of pulling conditions by electronic bombardment of polycrystalline silicon ribbons for solar cells -- French thesis p 55 A83-29946
- Design and fabrication of a prototype system for a photovoltaic residence in the Northeast
[DE82-022497] p 55 N83-16871
- Low-cost composite blades for the Mod-0A wind turbines p 170 N83-19242
- Design and evaluation of low cost blades for large wind driven generating systems p 170 N83-19244
- Status of the 4 MW WTS-4 wind turbine p 172 N83-19263
- Low-alloy steels for thick-walled pressure vessels
[DE83-002547] p 128 N83-21127
- Design and fabrication of a prototype system for photovoltaic residences in the southwest
[DE83-003935] p 72 N83-21200
- Photovoltaic concentrator with plastic-film reflector
[DE83-001715] p 75 N83-21547
- Energy-storage-flywheel housing-design-concept development
[DE82-014494] p 196 N83-21574
- Additional testing of the passive heat-pipe-cooled solar photovoltaic receiver
[DE-83-004474] p 78 N83-21615
- Design and demonstration of a spectrum-splitting photovoltaic concentrator module
[DE83-003669] p 79 N83-21634
- Parametric investigations and other related studies of energy storage type capacitors
[DE83-003426] p 197 N83-22785

FABRICS

- Energy conservation in electrostatic fabric filtration of industrial dust
[DE82-006897] p 15 N83-18036

FAILURE ANALYSIS

- Metallurgical investigation of disc cracking in the LP-2 turbine at a nuclear power station
[DE82-906428] p 162 N83-16515

FAN BLADES

- Energy efficient engine Fan test hardware detailed design report
[NASA-CR-165148] p 4 N83-16341

FARADAY EFFECT

- Measurement of plasma conductivity using Faraday rotation of submillimeter waves p 151 A83-23139

FARMLANDS

- Economic and engineering evaluation of plant oils as a diesel fuel
[DE83-900805] p 141 N83-22464

FATIGUE (MATERIALS)

- Physical properties data compilations relevant to energy storage Part 5 Mechanical properties data on alloys for use in flywheels
[PB82-232919] p 194 N83-18904

FATIGUE TESTS

- Structural fatigue test results for large wind turbine blade sections p 170 N83-19246
- Fatigue testing of low-cost fiberglass composite wind turbine blade materials
[NASA-CR-165566] p 181 N83-22746

FAULT TREES

- Intern Reliability Evaluation Program (IREP)
[DE82-004132] p 5 N83-16777

FEASIBILITY ANALYSIS

- A concept of heat pipe engine p 154 A83-27208
- Solar residential total energy system using the sodium heat engine - A concept study p 47 A83-27231
- Reversible chemical reactions for energy storage in a large-scale heat utility p 51 A83-27315
- Solar/gas Rankine/Rankine-cycle heat pump assessment
[PB82-254863] p 55 N83-16710
- Cogeneration in Municipalities Proceedings from Workshops for Local Governments and Municipal Utilities
[DE82-905758] p 6 N83-16921
- Conceptual design study Standard Floating Nuclear Power Plant on inshore site and Modified Floating Nuclear Power plant on upriver site
[DE82-007916] p 174 N83-19595
- Feasibility of applications of microwave technology for nuclear power plant radioactive wastes
[DE82-903143] p 29 N83-20744
- Real time sensors in geothermal fluids, their costs and benefits
[DE82-014857] p 130 N83-21328
- Roadway-powered electric-vehicle project
[DE83-003147] p 184 N83-23243

FEDERAL BUDGETS

- US solar and conservation technologies in international markets
[GPO-99-627] p 25 N83-20369

FEED SYSTEMS

- Mass flow of char/coal in oxygen-blown entrained-bed gasifiers An assessment of instruments and methods of measurement
[DE82-006988] p 107 N83-17852
- Partial liquefaction of coal by flash hydrolysis
[DE83-001145] p 126 N83-21077

FEEDBACK CONTROL

- Control design for a wind turbine-generator using output feedback p 152 A83-24721
- Control design and performance analysis of a 6 MW wind turbine-generator p 162 A83-29897

FERMENTATION

- Microorganisms for fermentation of crop residues
[DE82-006912] p 102 N83-17051
- Methanol production from fermentor off-gases
[DE83-005011] p 145 N83-22793

FERRI SURFACES

- Chalcogenide-glass solar cells
[DE82-021243] p 68 N83-20382

FERRITIC STAINLESS STEELS

- Evaluation of deterioration due to hot creep in chrome-molybdenum ferritic steels used in thermal power stations
[BLL-CE-TRANS-7669-(9022 09)] p 162 N83-16470

FIBER COMPOSITES

- Manufacture and testing of fibre composite rotor components /Fibre composite flywheel development program for road vehicle applications/
p 190 A83-27308

- The calculation of energy storage flywheels of fiber composites with electric energy converter -- German thesis p 191 A83-28666

FIBER REINFORCED COMPOSITES

- Program overview and diesel/flywheel hybrid power train design - Fibre composite flywheel development program for road vehicle applications p 190 A83-27306
- Fibre composite rotor selection and design /Fibre composite flywheel development program for road vehicle applications/
p 190 A83-27307

- Fiberglass composite blades for the 2 MW Mod-1 wind turbine generator p 170 N83-19241

- Hail impact testing procedure for solar collector covers
[PB83-104745] p 84 N83-22841

FILM THICKNESS

- Simulated in situ retorting of oil-shale in a controlled-state retort 3 Dynamic oil film thickness on partially retorted and unretorted shale
[DE82-011107] p 108 N83-18008

FILTRATION

- Dynamic modeling and control analysis of froth flotation and clean-coal filtration as applied to coal beneficiation
[DE82-004555] p 97 N83-16558

- Alkali-metal-vapor removal from pressurized fluidized-bed combustor flue gas
[DE82-008088] p 10 N83-16976

- Energy conservation in electrostatic fabric filtration of industrial dust
[DE82-006897] p 15 N83-18036

- Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery
[DE82-008705] p 140 N83-22436

FINANCIAL MANAGEMENT

- Status of the Great Plains coal gasification project, August 1982
[PB83-115139] p 130 N83-21188

FINITE DIFFERENCE THEORY

- MHD channel electrical boundary-layer theory and applications p 151 A83-23131

- Transient characteristics of flat-plate solar collector p 42 N83-23333

FINITE ELEMENT METHOD

- Finite element analysis of mixed convection applied to the storage of solar energy p 42 A83-23219

- Stability analysis of flexible wind turbine blades using finite element method
[NASA-CR-168107] p 177 N83-21508

- Finite-element analysis and modal testing of a rotating wind turbine
[DE83-002609] p 180 N83-21608

- Development of methodology for horizontal axis wind turbine dynamic analysis
[NASA-CR-168110] p 181 N83-22747

- Additional testing of the passive heat-pipe-cooled solar photovoltaic receiver
[DE-83-004474] p 78 N83-21615

- Gulf coast ecological inventory user's guide and information base
[DE83-900406] p 28 N83-20455

- Laminar burning velocities of hydrogen-air and hydrogen-air-steam flames p 85 A83-19837

- Flames with impinging jets p 91 A83-21423

- A study on the hydrogen-oxygen diffusion flame in high speed flow p 93 A83-26199

- Recent flame-propagation experiments at LLNL within the liquefied gaseous-fuels spill-safety program
[DE82-010729] p 103 N83-17651

- Flame acceleration mechanisms under conditions of partial confinement
[PB83-109884] p 120 N83-19881

- Laser fluorescence measurements of the OH concentration in a combustion boundary layer p 86 A83-24367

- Volatile production during preignition coal heating
[DE82-011241] p 95 N83-16445

- Review of alternative fuels data bases
[NASA-CR-170203] p 140 N83-22439

- Premixed, turbulent combustion of a sudden-expansion flow p 92 A83-23748

- Radiation and smoke from the gas turbine combustor using heavy fuels p 92 A83-23877

- Review of alternative fuels data bases
[NASA-CR-170203] p 140 N83-22439

- Diffusion flame studies of the chemical and physical mechanisms of soot formation from aromatic and substituted aromatic fuels
[DE82-009310] p 120 N83-19879

- Particulate processes in pulverized-coal flames
[DE82-014306] p 140 N83-22367

- Linear static and dynamic analysis for hinged rotor blades of 60 m span for a two bladed horizontal axis wind energy converter
[ISO-291] p 167 N83-18030

- Phase equilibrium properties of coal derived liquids
[DE82-007006] p 102 N83-17638

- Transient characteristics of flat-plate solar collector p 42 A83-23333

- Flat-plate solar collectors utilizing polymeric film for high performance and very low cost
[DE82-004797] p 56 N83-16877

- Contact stresses on a thin plate after large displacements to a half parabolic surface
[DE82-006998] p 63 N83-19136

- Large area silicon sheet by EFG
[NASA-CR-169920] p 63 N83-19219

- Photovoltaic array Power conditioner interface characteristics
[NASA-CR-169919] p 64 N83-19225
Solar-energy-system performance evaluation
Honeywell OTS 44, Ocmulgee, Georgia
[NASA-CR-170031] p 74 N83-21530
Intermediate photovoltaic system application experiment
operational performance Volume 5 Beverly High School,
Beverly Massachusetts, Executive summary
[DE82-014711] p 76 N83-21563
Design approaches for solar industrial process-heat
systems Nontracking and line-focus collector
technologies
[DE83-003339] p 79 N83-21620
Photovoltaic cell and module status assessment.
Volume 2 Technology basis
[DE83-900575] p 79 N83-21627
- FLIGHT CONTROL**
An on-board near-optimal climb-dash energy
management
[NASA-CR-169755] p 4 N83-16329
- FLIGHT OPTIMIZATION**
Energy conservation in air transportation - The Canadian
Air Traffic Control Effort p 4 A83-29393
- FLIGHT PLANS**
A practical economic criterion for fuel conservation
p 12 N83-17468
- FLIGHT TESTS**
The MCA method, a flight test technique to determine
the thrust of jet aircraft in flight - Mass Consumption
Acceleration p 1 A83-19661
- FLOATING**
Conceptual design study Standard Floating Nuclear
Power Plant on inshore site and Modified Floating Nuclear
Power plant on upriver site
[DE82-007916] p 174 N83-19595
- FLORIDA**
Innovative photovoltaic application for residences
experiment
[DE83-000399] p 57 N83-16898
- FLOTATION**
Dynamic modeling and control analysis of froth flotation
and clean-coal filtration as applied to coal beneficiation
[DE82-004555] p 97 N83-16558
- FLOW CHARTS**
US energy flow, 1981
[DE83-001579] p 18 N83-18081
- FLOW DISTRIBUTION**
Flow distribution control characteristics in marine gas
turbine waste-heat recovery system Phase 2. Flow
distribution control in waste-heat steam generators
[AD-A119310] p 175 N83-20054
- FLOW MEASUREMENT**
Joint measurements of radial velocity and scalars in a
turbulent diffusion flame p 86 A83-24365
Mass flow of char/coal in oxygen-blown entrained-bed
gasifiers An assessment of instruments and methods
of measurement
[DE82-006988] p 107 N83-17852
The wake of the MOD-0A1 wind turbine at two rotor
diameters downwind on December 3, 1981
[DE83-003305] p 180 N83-21622
- FLOW STABILITY**
Flow instability during direct steam generation in a
line-focus solar-collector system
[DE82-012867] p 70 N83-20404
- FLOW VELOCITY**
Velocity measurements in an axisymmetric laminar flow
using an optical technique of visualization in coherent
light p 54 A83-29704
Contemporary Systems, Inc., Walpole, New Hampshire
solar-energy-system performance evaluation
[DE83-000068] p 57 N83-16894
High power pulsed plasma MHD experiments
[AD-A120526] p 176 N83-20781
Low-temperature pyrolysis of coal to produce diesel-fuel
blends
[DE83-001637] p 126 N83-21076
Advanced atmospheric fluidized-bed combustion design
Ultrahigh velocity
[DE83-004819] p 128 N83-21088
Additional testing of the passive heat-pipe-cooled solar
photovoltaic receiver
[DE-83-004474] p 78 N83-21615
- FLOW VISUALIZATION**
Velocity measurements in an axisymmetric laminar flow
using an optical technique of visualization in coherent
light p 54 A83-29704
- FLUE GASES**
Development of heat exchangers for reheating scrubbed
flue gas in a pilot plant
[BMFT-FB-T-82-169] p 13 N83-17840
Testing of heat exchanger systems for reheating flue
gases from wet scrubbing desulfurization plants
[BMFT-FB-T-82-170] p 13 N83-17841
- Magnesia spray absorption for the removal of SO₂ from
flue gas
[DE82-013443] p 28 N83-20456
Acid rain mitigation study Volume 1 FGD cost
estimates
[PB83-101329] p 29 N83-20459
Acid rain mitigation study Volume 2 FGD cost
estimates, appendices
[PB83-117366] p 29 N83-20469
Desulfurization of solid fuels in power stations by
superconductive magnets
[BLL-CE-TRANS-7855-(9022 09)] p 125 N83-21051
Flue gas desulfurization with waste water evaporation
Phase 2 Observation of the experiments at Weiher II
[BMFT-FB-T-82-026] p 125 N83-21053
- FLUES**
Construction and operation of a central heating plant
prototype heated by coal dust corresponding to the
Schoppe system
[BMFT-FB-T-82-176] p 109 N83-18031
- FLUID DYNAMICS**
General review of wind engineering problems
p 114 N83-18944
- FLUID FILMS**
Simulated in situ retorting of oil-shale in a
controlled-state retort. 3 Dynamic oil film thickness on
partially retorted and unretorted shale
[DE82-011107] p 108 N83-18008
- FLUID FLOW**
Aquifer thermal-energy-storage modeling
[DE83-900672] p 197 N83-22794
- FLUID INJECTION**
Reinjection and injection of fluids in geothermal
operations (state of the art)
[DE83-001857] p 135 N83-21632
- FLUID MECHANICS**
Combustion research needs
[PB83-107813] p 128 N83-21091
Some basic research problems related to energy
[DE83-003753] p 195 N83-21527
The investigation of passive blade cyclic pitch variation
using an automatic yaw control system
[DE83-000651] p 178 N83-21548
- FLUID PRESSURE**
Type-curve analysis of pressure buildup from vertically
fractured wells in low permeability reservoirs
[DE82-010513] p 115 N83-19198
- FLUIDIC CIRCUITS**
Back-to-back test for determining the pumping losses
in a Stirling cycle machine p 158 A83-27290
- FLUIDIZED BED PROCESSORS**
Alkali-metal-vapor removal from pressurized
fluidized-bed combustor flue gas
[DE82-008088] p 10 N83-16976
Fossil-energy program
[DE82-007502] p 111 N83-18083
Trace and minor element reactions in fluidized-bed
combustion processes
[PB82-240219] p 113 N83-18883
Coal pyrolysis by hot solids from a fluidized-bed
combustor
[DE83-003344] p 117 N83-19829
Coal desulfurization by a microwave process
[DE82-007514] p 118 N83-19854
Engineering systems analysis of pressurized
fluidized-bed combustion power systems
[DE82-013390] p 127 N83-21083
Advanced atmospheric fluidized-bed combustion design
Ultrahigh velocity
[DE83-004819] p 128 N83-21088
Selecting and testing oxygen-measuring systems for
fluidized-bed combustors
[DE83-005987] p 128 N83-21089
Power plant concepts using new coal conversion
technologies
[BMFT-FB-T-82-031] p 131 N83-21506
Gas characterization from fluidized-bed coal
gasification
[DE82-012396] p 138 N83-22357
Study of the electrowinning of copper using a
fluidized-bed electrochemical reactor
[DE83-004854] p 181 N83-22404
- FLUORESCENCE**
EA study of solar concentrator panels with fluorescent
compounds p 40 A83-22911
The uranyl ion, fluorescent and fluorene-like - A review
p 45 A83-26061
- FLUORIDES**
Performance of a cylindrical phase-change thermal
energy storage unit p 191 A83-28969
- FLUORINATION**
The electrochemical fluorination of polymeric materials
for high energy density aqueous and non-aqueous battery
and fuel cell separators
[NASA-CR-167961] p 177 N83-21056
- FLUSHING**
Guidelines for sampling and analyzing solutions for
aquifer thermal-energy-storage systems
[DE83-001852] p 10 N83-16973
- FLUTTER**
Development of an oscillating-vane concept as an
innovative wind-energy-conversion system
[DE82-012870] p 179 N83-21599
- FLY ASH**
Coal-waste artificial-reef program, phase 3 Volume 2
Comprehensive report
[DE82-005591] p 8 N83-16954
Leachate-treatment technique utilizing fly ash as
low-cost sorbent
[DE82-010501] p 111 N83-18101
- FLYWHEELS**
Study on composite flywheels for energy storage
p 188 A83-22701
Energy utilization of electric and hybrid vehicles
p 188 A83-27164
Recent advances in composite flywheel containment
design technology p 189 A83-27302
Compression molded energy storage flywheels
p 189 A83-27303
Twin disk composite flywheel p 189 A83-27304
Program overview and diesel/flywheel hybrid power train
design - Fibre composite flywheel development program
for road vehicle applications p 190 A83-27306
Fibre composite rotor selection and design /Fibre
composite flywheel development program for road vehicle
applications/ p 190 A83-27307
Manufacture and testing of fibre composite rotor
components /Fibre composite flywheel development
program for road vehicle applications/ p 190 A83-27308
Analysis of fixed-base flywheel systems for electric utility
applications p 190 A83-27310
The calculation of energy storage flywheels of fiber
composites with electric energy converter - German
thesis p 191 A83-28666
Impact of flywheel-energy-storage technology upon
taxicab fleet operation in a large metropolitan city
[DE82-002371] p 194 N83-18591
Physical properties data compilations relevant to energy
storage Part 5 Mechanical properties data on alloys
for use in flywheels
[PB82-232919] p 194 N83-18904
Design of plywood and paper flywheel rotors
[DE83-002276] p 195 N83-20430
Energy-storage-flywheel housing-design-concept
development
[DE82-014494] p 196 N83-21574
Study of vacuum systems for a heat engine/flywheel
automotive propulsion system
[DE83-002284] p 198 N83-23244
- FOCUSING**
Program for predicting thermal performance based on
test data of low- to medium-temperature line-focusing,
concentrating solar collectors
[DE82-012605] p 82 N83-22776
- FOOD PROCESSING**
Demonstration of a solar/wind-powered
electrostatic-field food-keeping device
[DE82-007971] p 65 N83-19285
- FORECASTING**
Characterization and supporting research for in-situ
coal-gasification research and development project plan
[DE83-000962] p 101 N83-16910
The useful potential of using existing data to uniquely
identify predictable wind events and regimes, part 1
p 116 N83-19250
The useful potential of using existing data to uniquely
identify predictable wind events and regimes, part 2
p 116 N83-19251
Integrated forecasting model synthetic fuels study
Volume 1 Overview and findings
[DE82-903574] p 121 N83-19943
US energy for the rest of the century
[PB83-114603] p 36 N83-22838
- FORESTS**
Energy inputs and outputs of fuel-alcohol production,
appendices C through F Methanol from cellulose
[DE83-000369] p 130 N83-21178
Energy from biomass Land analysis and evaluation
of supply models
[DE83-003333] p 132 N83-21524
- FORGING**
Enhancement of energy savings through accelerated
implementation of high-performance forge furnaces
[DE82-010913] p 32 N83-21578
- FORMING TECHNIQUES**
Deformation of a thin, elastic plate to a deep parabolic
cylinder
[DE82-012056] p 72 N83-21413

FORTRAN

- PLTSYM A FORTRAN computer system to plot Canadian symbol location maps for hydrogeochemical and stream-sediment reconnaissance data
[DE83-000764] p 123 N83-20337

FOSSIL FUELS

- Development and application of advanced diagnostics methods in fossil fuel combustion studies
p 90 A83-20436
- Distribution of and changes in industrial carbon dioxide production
p 2 A83-24256
- Health and safety issues of alternate energy systems
[DE82-002918] p 9 N83-16959
- Pacific Northwest biomass as an energy resource
[DE82-005804] p 110 N83-18047
- Fossil energy program
[DE82-007496] p 111 N83-18082
- Fossil-energy program
[DE82-007502] p 111 N83-18083
- Advanced research and technology development fossil energy materials program
[DE82-007121] p 111 N83-18085
- External combustion steam injected gas turbine
[DE82-019862] p 168 N83-19102
- State-of-the-art combustion modification NOx control for stationary combustion equipment
[PB82-240201] p 23 N83-19340
- Liquid fossil-fuel technology
[DE83-002501] p 121 N83-19937
- Fossil-energy
[DE83-003817] p 124 N83-20383
- Proceedings of the 1981 Symposium on Instrumentation and Control for Fossil-energy Processes
[DE82-011999] p 124 N83-20406
- Combustion research needs
[PB83-107813] p 128 N83-21091
- Centaur gas-turbine modification and development for solar-fossil hybrid operation
[DE83-000192] p 177 N83-21366
- Fossil energy materials program plan for fiscal years 1982 through 1986
[DE83-004237] p 131 N83-21519
- Energy from biomass Land analysis and evaluation of supply models
[DE83-003333] p 132 N83-21524
- Ceramic heat-exchanger applications study
[DE83-003166] p 132 N83-21529
- The Alternative Fuels for Medium Speed Diesel Engines (AFFMSDE) project A baseline program planning concept for review and revision
[DE83-002565] p 141 N83-22461
- Computer-aided industrial process design The ASPEN project
[DE82-014469] p 181 N83-22484
- Electrical generation
p 143 N83-22676
- Fuel quality-processing study Volume 1 Overview and results
[NASA-CR-165326-VOL-1] p 143 N83-22750
- Fuel quality-processing study Volume 2 Literature survey
[NASA-CR-165326-VOL-2] p 143 N83-22751
- Exploration deliberations
p 144 N83-22762
- Exploitation deliberations
p 144 N83-22763
- Fuel-cell-propelled submarine-tanker-system study
[DE82-015149] p 183 N83-22827
- Acid precipitation and the use of fossil fuels
[GPO-98-172] p 36 N83-22846

FOURIER TRANSFORMATION

- Finite-element analysis and modal testing of a rotating wind turbine
[DE83-002609] p 180 N83-21608

FRACTIONATION

- Fractionation of an oil shale retort process water
Isolation of photoactive genotoxic components
[DE82-010428] p 108 N83-18014

FRACTURE MECHANICS

- Minimum silicon wafer thickness for ID wafering
p 41 A83-22924
- Reservoir engineering transient pressure well testing, and petrophysical analyses of western gas sands
[DE82-004879] p 99 N83-16839
- Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures
[AD-A113883] p 72 N83-20802
- Stratigraphic variations in oil-shale fracture properties
[DE82-021088] p 136 N83-21702

FRACTURING

- Type-curve analysis of pressure buildup from vertically fractured wells in low permeability reservoirs
[DE82-010513] p 115 N83-19198

FREE CONVECTION

- Numerical calculation of the heat transfer by natural convection in a cubical enclosure
p 42 A83-23212
- A 2D model of turbulent solar induced flows in passive air collectors
p 53 A83-29039

- Thermal-convection-loop study of the corrosion of Fe-Ni-Cr alloys by molten NaNO₃/sub 3-KNO₃/sub 3
[DE83-004228] p 80 N83-22407

FREEZING

- Fuel/engine/airframe trade-off study Operational effects of increased freeze point fuels
[AD-A121688] p 129 N83-21169
- Steam generation in line-focus solar collectors A comparative assessment of thermal performance, operating stability and cost issues
[DE82-014531] p 76 N83-21568

FREON

- A study on two-phase, two-component Stirling engine
p 160 N83-27328

FREQUENCY DISTRIBUTION

- Solar altitude frequency tables
p 39 A83-22617

FRESH WATER

- Statistical database management for ecosystem-effects analysis
[DE82-005199] p 18 N83-18104
- Assessment of the need for dry cooling, 1981 update
[DE82-009395] p 146 N83-22803

FRESNEL LENSES

- Design and development of monolithic acrylic Fresnel lenses for use in point-focus PV systems
[DE82-007554] p 72 N83-20768
- Design and demonstration of a spectrum-splitting photovoltaic concentrator module
[DE83-003669] p 79 N83-21634

FRICTION

- Wave model A numerical model for the frictional absorption of water waves
[PB83-100792] p 122 N83-20073

FUEL CELL POWER PLANTS

- Fuel-cell technology assessment Volume 2 Evaluation of Japan
[DE83-004146] p 182 N83-22771
- Fuel-cell technology assessment Volume 3 Evaluation of Tunisia
[DE83-004294] p 182 N83-22772
- Fuel-cell technology assessment Volume 5 Evaluation of South Korea
[DE83-004299] p 182 N83-22773
- Fuel-cell technology assessment Volume 4 Evaluation of Taiwan
[DE83-004160] p 183 N83-22810
- Fuel-cell technology assessment Volume 1 The potential value of US fuel-cell technology in foreign countries
[DE83-004372] p 183 N83-22820

FUEL CELLS

- The structure of the double layer at the mercury-phosphoric acid interface from studies of adsorption of thiourea and its implications on oxygen reduction kinetics --- in fuel cells
p 149 A83-19876
- Molten carbonate fuel cell performance model
p 149 A83-19864
- Simple porous electrode models for molten carbonate fuel cells
p 149 A83-19891
- The equilibrium constant for the reversible reaction $H_2S + 3H_2O + /LiO 66K0 34/2 CO_3 yields 4H_2 + CO_2 + /LiO 66K0 34/2 SO_4$ at elevated temperature --- in molten carbonate fuel cells
p 150 A83-20590
- Porous perovskite electrode as molten carbonate cathode --- in fuel cells
p 150 A83-20596
- Coating applications for the molten carbonate fuel cell
p 153 A83-25538
- A zinc paste primary battery --- for electric vehicles
p 153 A83-26052
- Assessment of phosphoric acid and trifluoromethane sulfonic acid fuel cells for vehicular powerplants
p 154 A83-27162
- Abuse resistant high rate lithium/thionyl chloride cells
p 154 A83-27180
- Acid fuel cell technologies for vehicular power plants
p 154 A83-27185
- Status of solid polymer electrolyte fuel cell technology and potential for transportation applications
p 154 A83-27186
- Pore size engineering applied to starved electrochemical cells and batteries
p 154 A83-27201
- Evaluation of tetrafluoroethane-1,2-disulfonic acid as a fuel cell electrolyte
p 161 A83-28300
- Hot-gas cleanup for molten-carbonate fuel cells
[DE82-002500] p 163 N83-16864
- Experimental techniques for the study of photosynthetic water splitting
[DE82-003974] p 89 N83-17668
- Evaluation of gasification and gas-cleanup processes for use in molten-carbonate fuel-cell power plants
[DE82-012244] p 167 N83-18084
- Hybrid fuel cell/diesel generation total energy system, part 2
[NASA-CR-169912] p 115 N83-19217

- On-site fuel cell power plant technology development program
[PB83-102335] p 176 N83-20437
- On-site fuel cell field test support program
[PB83-121723] p 28 N83-20439
- Energy generating and storing method for space application
p 177 N83-21021
- The electrochemical fluorination of polymers materials for high energy density aqueous and non-aqueous battery and fuel cell separators
[NASA-CR-167961] p 177 N83-21056
- Electromigrational composition gradients in molten carbonates A review
[DE83-002593] p 177 N83-21075
- Systems analysis of on-site integrated energy systems, phase 1
[DE83-000044] p 179 N83-21549
- Study of net soot formation in hydrocarbon reforming for hydrogen fuel cells
[DE83-001046] p 90 N83-22352
- Fuel-cell technology assessment. Volume 2 Evaluation of Japan
[DE83-004146] p 182 N83-22771
- Fuel-cell technology assessment Volume 3 Evaluation of Tunisia
[DE83-004294] p 182 N83-22772
- Fuel-cell technology assessment Volume 5 Evaluation of South Korea
[DE83-004299] p 182 N83-22773
- Evaluation of gasification and gas cleanup processes for use in molten carbonate fuel cell power plants
[DE83-003821] p 183 N83-22787
- Coordination of the on-site fuel cell program
[PB83-119545] p 184 N83-22839
- HYFIRE A Tokamak/high-temperature electrolysis system
[DE82-013851] p 90 N83-23173

FUEL COMBUSTION

- Development and application of advanced diagnostics methods in fossil fuel combustion studies
p 90 A83-20436
- Investigation of slurry fuel performance for use in a ramjet propulsor
p 90 A83-21014
- Droplet size effects on NO_x/ formation in a one-dimensional monodisperse spray combustion system
[ASME PAPER 82-JPGC-GT-10] p 93 A83-25268
- Catalytic combustion with steam injection
[ASME PAPER 82-JPGC-GT-23] p 93 A83-25271
- Spray combustion processes - A review
[ASME PAPER 82-WA/HT-86] p 93 A83-25691
- Propagation at 10 microns through smoke produced by atmospheric combustion of diesel fuel
p 3 A83-26641
- Test report on the combustion of PERC and LBL wood oils
[DE82-004485] p 95 N83-16429
- Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 2 User's manual for a computer program for 1-dimensional coal combustion or gasification (1-DICOG)
[DE82-015610] p 119 N83-19868
- Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 3 User's manual for a computer program for 2-Dimensional Coal Gasification or Combustion (PCGC-2)
[DE82-015611] p 119 N83-19869
- Fuel property effects on diesel engine and gas turbine combustor performance
[AD-A120879] p 175 N83-20161
- Critical research and advanced technology (CRT) support project
[NASA-TM-83019] p 123 N83-20361
- Proceedings of the 1981 Symposium on Instrumentation and Control for Fossil-energy Processes
[DE82-011999] p 124 N83-20406
- Basic combustion and pollutant-formation processes for pulverized fuels
[DE82-013773] p 29 N83-20457
- Combustion of oil on water An experimental program
[DE82-014598] p 127 N83-21084
- Propanol-plus as extender to diesel fuel
[CSIR-ME-445] p 128 N83-21165
- A study of possible detrimental effects on internal combustion engines by the combustion of gasohol blends
[CSIR-ME-446] p 129 N83-21166
- Reverse-combustion, horizontal retorting of oil shale
[DE83-000018] p 137 N83-22350
- Study of net soot formation in hydrocarbon reforming for hydrogen fuel cells
[DE83-001046] p 90 N83-22352
- Effect of liquefaction processing conditions on combustion characteristics of solvent-refined coal
[DE82-903665] p 139 N83-22361

FUEL CONSUMPTION

- Review of alternative fuels data bases
[NASA-CR-170203] p 140 N83-22439
- FUEL CONSUMPTION**
- PW 4000 - A radically new jet engine being developed in the USA p 1 A83-23239
- Structures and mechanisms - Streamlining for fuel economy p 2 A83-24361
- Energy conservation in air transportation - The Canadian Air Traffic Control Effort p 4 A83-29393
- Emulsified fuel testing in a medium speed diesel engine p 98 N83-16564
- [PB82-250697] p 98 N83-16564
- Evaluation of utility home-energy-audit programs A Wisconsin example p 6 N83-16924
- [DE82-008134] p 6 N83-16924
- Influence of driver behavior on fuel consumption Bibliographic study p 11 N83-17086
- [IRT-58] p 11 N83-17086
- Symposium on Commercial Aviation Energy Conservation Strategies Papers and presentations [AD-A107106] p 11 N83-17455
- Potential fuel savings through improved airframe maintenance p 11 N83-17456
- Aircraft towing feasibility study p 11 N83-17458
- An overview of the DOT/FAA aviation energy conservation policy p 12 N83-17460
- Fuel conservation techniques in jet transport aircraft operations p 12 N83-17463
- Air traffic control Its effect on fuel conservation p 12 N83-17464
- Computenzed engine and airplane performance monitoring programs p 12 N83-17465
- Slidestop indication system p 12 N83-17466
- Turbine engine fuel conservation by fan and compressor profile control p 12 N83-17467
- A practical economic criterion for fuel conservation p 12 N83-17468
- Technical standards for fuel consumption in private automobiles p 106 N83-17735
- [DE82-900748] p 106 N83-17735
- Model simplification to examine the interrelationships between coal, gas and oil use p 110 N83-18061
- [DE82-007816] p 110 N83-18061
- Impact of flywheel-energy-storage technology upon taxicab fleet operation in a large metropolitan city p 194 N83-18591
- [DE82-002371] p 194 N83-18591
- General aviation airplane fuel economy system model p 20 N83-18647
- Implementation of R & QA practices in Research and Development programs p 24 N83-19651
- [NASA-TM-82997] p 24 N83-19651
- District heating and more-efficient buildings p 26 N83-20379
- [DE81-025437] p 26 N83-20379
- Review and evaluation of automotive fuel conservation technologies p 30 N83-20844
- [PB83-101139] p 30 N83-20844
- Fleet experience using a methanol/unleaded gasoline blend p 129 N83-21171
- [DE83-003834] p 129 N83-21171
- Energy inputs and outputs of fuel-alcohol production, appendices C through F Methanol from cellulose p 130 N83-21178
- [DE83-000369] p 130 N83-21178
- Fuel conservation and economy constraints p 34 N83-22179
- Industry's assessment of the number of airplanes in the general aviation fleet along with their hours flown and fuel consumption data powered by what type of engines, when and for what reasons, through the year 2000 p 140 N83-22445
- [DE83-000776] p 140 N83-22445
- Oil and gas p 34 N83-22674
- Higher level of utilization of fuel-energy resources [BLL-M-26855-(5825 4)] p 35 N83-22737
- [BLL-M-26855-(5825 4)] p 35 N83-22737
- Acid precipitation and the use of fossil fuels [GPO-98-172] p 36 N83-22846
- [GPO-98-172] p 36 N83-22846
- FUEL CORROSION**
- High temperature erosion and erosion-hot corrosion of superalloys and coatings p 91 A83-21458
- FUEL FLOW**
- The generation of electric currents by the turbulent flow of dielectric liquids I - Long pipes p 161 A83-29089
- FUEL INJECTION**
- Catalytic combustion with steam injection [ASME PAPER 82-JPGG-GT-23] p 93 A83-25271
- FUEL OILS**
- Test report on the combustion of PERC and LBL wood oils p 95 N83-16429
- [DE82-004485] p 95 N83-16429
- Energy-efficient alcohol-fuel production p 122 N83-19944
- [DE82-011278] p 122 N83-19944
- American technology transfer and Soviet energy planning p 26 N83-20373
- [GPO-97-481] p 26 N83-20373
- Survey of large combustors Alternative fuel burning capabilities of large boilers in 1979 p 127 N83-21079
- [DE82-008386] p 127 N83-21079

- Combustion of oil on water An experimental program [DE82-014598] p 127 N83-21084
- Oil/refuse homogenization. An approach to combustion of refuse in existing oil-fired boilers p 138 N83-22353
- [DE82-011848] p 138 N83-22353
- FUEL PRODUCTION**
- The properties of fuel fractions obtained by the hydrogenation of Kansk-Achinsk coal p 94 A83-28920
- A viable process for producing hydrogen syngas using nuclear fusion heat p 87 A83-27210
- Instrumental methods of analysis of sulfur compounds in syngas process streams p 95 N83-16446
- [DE82-011559] p 95 N83-16446
- Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels p 96 N83-16459
- [PB82-255167] p 96 N83-16459
- Process engineering and mechanical design reports Volume 1 Preliminary design and assessment of a 50,000 BPD coal-to-methanol-to-gasoline plant p 97 N83-16559
- [DE83-000848] p 97 N83-16559
- Design, construction, operation and costs of a modern small-scale fuel-alcohol plant p 107 N83-17754
- [DE82-011019] p 107 N83-17754
- Devonian shale extraction test wells p 108 N83-18013
- [DOE/MC-08386/T1] p 108 N83-18013
- Western oil shale development A technology assessment Volume 8 Health effects of oil shale development p 109 N83-18015
- [DE82-008695] p 109 N83-18015
- Advanced research and technology development fossil energy materials program p 111 N83-18085
- [DE82-007121] p 111 N83-18085
- Entrained flow, ablative fast pyrolysis of biomass p 113 N83-18875
- [DE82-005791] p 113 N83-18875
- International energy indicators p 26 N83-20405
- [DE82-012504] p 26 N83-20405
- Devising efficient biotechnological processes for the production of fuels and chemicals from biomass p 124 N83-20418
- [DE82-017089] p 124 N83-20418
- Technical/commercial feasibility study of the production of fuel-grade ethanol for corn 100-million gallon-per-year production facility in Myrtle Grove, Louisiana p 129 N83-21173
- [DE83-000772] p 129 N83-21173
- Energy inputs and outputs of fuel-alcohol production, summary volume p 129 N83-21174
- [DE83-000367] p 129 N83-21174
- Energy inputs and outputs of fuel-alcohol production Appendices A and B, ethanol from grain p 129 N83-21175
- [DE83-000368] p 129 N83-21175
- Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana Volume 1 Executive summary p 132 N83-21531
- [DE83-000777] p 132 N83-21531
- Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana p 132 N83-21532
- [DE83-000776] p 132 N83-21532
- Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana p 133 N83-21534
- [DE83-000773] p 133 N83-21534
- Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana p 133 N83-21535
- [DE83-000774] p 133 N83-21535
- Benefits analysis for the production of fuels and chemicals using solar thermal energy p 74 N83-21542
- [DE83-001023] p 74 N83-21542
- Manne biomass New York state site and species study compositional analysis and systems studies p 142 N83-22470
- [PB83-126078] p 142 N83-22470
- Fuel quality-processing study Volume 1 Overview and results p 143 N83-22750
- [NASA-CR-165326-VOL-1] p 143 N83-22750
- Fuel quality-processing study Volume 2 Literature survey p 143 N83-22751
- [NASA-CR-165326-VOL-2] p 143 N83-22751
- Fuel quality-processing study Volume 3 Fuel upgrading studies p 144 N83-22754
- [NASA-CR-165326-VOL-3] p 144 N83-22754
- Ethanol production in small- to medium-size facilities p 146 N83-22807
- [DE83-900875] p 146 N83-22807
- State of California Resource-recovery profile p 146 N83-22812
- [DE83-004949] p 146 N83-22812
- International Energy Workshop, 1981 p 36 N83-22816
- [DE82-021183] p 36 N83-22816

- Underground Coal Gasification (UCG) gas to methanol and MTG-gasoline An economic and sensitivity study, task B p 146 N83-22821
- [DE83-004320] p 146 N83-22821
- Alternative motor fuels p 148 N83-23214
- FUEL SPRAYS**
- Degradation and characterization of antimisting kerosene p 92 A83-24035
- Droplet size effects on NO_x formation in a one-dimensional monodisperse spray combustion system p 93 A83-25268
- [ASME PAPER 82-JPGG-GT-10] p 93 A83-25268
- Spray combustion processes - A review p 93 A83-25691
- [ASME PAPER 82-WA/HT-86] p 93 A83-25691
- FUEL SYSTEMS**
- Fossil energy materials program plan for fiscal years 1982 through 1986 p 131 N83-21519
- [DE83-004237] p 131 N83-21519
- Aviation Gasolines and Future Alternatives p 140 N83-22442
- [NASA-CP-2267] p 140 N83-22442
- Fuel supply and distribution Fixed base operation p 141 N83-22449
- Future of alternate fuels for turbine engines p 141 N83-22453
- FUEL TESTS**
- Development of high-temperature liquid metal heat pipes for isothermal irradiation assemblies - for in-pile tests of UO₂ space reactor fuel configurations p 185 A83-27129
- Emulsified fuel testing in a medium speed diesel engine p 98 N83-16564
- [PB82-250697] p 98 N83-16564
- FUEL VALVES**
- The assessment of variable valve timing of internal combustion engines for fuel economy improvements and practicability p 5 N83-16766
- [PB82-265364] p 5 N83-16766
- FUEL-AIR RATIO**
- Laminar burning velocities of hydrogen-air and hydrogen-air-steam flames p 85 A83-19837
- Prediction of turbulent mixing in confined co-axial reacting jets p 91 A83-23191
- Using a global hydrogen-air combustion model in turbulent reacting flow calculations p 86 A83-24667
- FUELS**
- Investigation of methanol as a boiler fuel for electric-power generation p 97 N83-16560
- [DE82-905495] p 97 N83-16560
- Landfill gas to electricity demonstration project p 7 N83-16943
- [PB82-255290] p 7 N83-16943
- Economic incentives for additional critical experimentation applicable to fuel dissolution p 106 N83-17737
- [DE82-006818] p 106 N83-17737
- West Europe report Science and technology, no 133 [JPRS-82608] p 89 N83-17757
- Analytical and policy issues in energy economics Uses of the FRS data base p 16 N83-18051
- [DE82-004258] p 16 N83-18051
- Effect of low-proof alcohol fumigation-fueling on crankcase oil dilution in a diesel-cycle engine p 122 N83-20171
- [DE83-002976] p 122 N83-20171
- Ignition technique for conventional motors by high energy spark p 142 N83-22594
- [INPE-2645-TDL/116] p 142 N83-22594
- FURNACES**
- The use of slurry fuels in industrial furnaces [TAE-428] p 106 N83-17729
- [TAE-428] p 106 N83-17729
- Utilization of secondary energy resources at Magnitogorsk Metallurgical Combine p 131 N83-21502
- [BLL-M-26856-(5828 4)] p 131 N83-21502
- Enhancement of energy savings through accelerated implementation of high-performance large furnaces p 32 N83-21578
- [DE82-010913] p 32 N83-21578
- Multi-fuel low-NO_x burner development, phase 2 p 147 N83-22845
- [PB83-126292] p 147 N83-22845
- FUSION REACTORS**
- A viable process for producing hydrogen syngas using nuclear fusion heat p 87 A83-27210
- Overview of fusion reactor safety p 166 N83-17331
- [DE82-005951] p 166 N83-17331
- Survey of nuclear fusion technology A prospect analysis of Tokamak fusion research p 168 N83-18451
- [DE82-700131] p 168 N83-18451
- Tritium transport and control in the FED p 168 N83-18511
- [DE82-002592] p 168 N83-18511
- Utilization of the catalyzed-DD fuel cycle in Reversed-Field Pinch Reactors (RFPRs) p 168 N83-18512
- [DE82-010425] p 168 N83-18512
- Fusion technology status and requirements p 174 N83-19615
- [DE82-010754] p 174 N83-19615
- Fiscal year 1983 Department of Energy budget review Magnetic fusion energy Volume 5 p 175 N83-20372
- [GPO-98-550] p 175 N83-20372

SUBJECT INDEX

G

GALLIUM ARSENIDES

- A model for the collection of minority carriers generated in the depletion region of a Schottky barrier solar cell
p 40 A83-22910
- Space applications of gallium arsenide solar cells
p 50 A83-27258
- Status of GaAs solar cells for space power applications
p 50 A83-27259
- A method for producing heat pipes for cooling semiconductor photovoltaic cells and the heat pipe characteristics
p 52 A83-28366
- Polycrystalline solar cell/substrate growth by integrated vacuum evaporation
p 58 N83-16917
- Effects of grain boundaries in GaAs solar cells
p 61 N83-18059
- Design rules for a 100X maximum efficiency GaAs concentrator solar cell for space applications
[NASA-CR-170005] p 67 N83-20362

GAME THEORY

- Interim Reliability Evaluation Program (IREP)
[DE82-004132] p 5 N83-16777
- Game-theory approach to consumer incentives for solar energy
p 56 N83-16882
- An Energy Crisis Management Simulation for the State of California
[RAND/R-2899-CEC] p 25 N83-20363

GAS ANALYSIS

- Oil shale project run summary small retort run S-7
[DE82-004731] p 99 N83-16837
- Synthetic fuel effects in continuous combustion systems
An experimental study of fuel nitrogen conversion in jet-stirred combustions
p 103 N83-17646
- Development of a continuous methane monitor
[PB82-244245] p 114 N83-19078
- Multiple-tracer gas analyzer
[DE82-017032] p 120 N83-19876

GAS CHROMATOGRAPHY

- Chemical effects in vaporizing synthetic fuels
[DE82-003352] p 96 N83-16549
- Partial liquefaction of coal by flash hydrolysis, phase 4
[DE83-002167] p 127 N83-21085
- Catalytic coal conversion support Use of laser flash-pyrolysis for structural analysis
[DE82-014124] p 139 N83-22366

GAS COMPOSITION

- Problems in organic geochemistry applied to petroleum exploration and production
p 144 N83-22765

GAS DYNAMICS

- Radiative energy receiver for high performance energy conversion cycles
p 46 A83-27138

GAS EXPLOSIONS

- Recent flame-propagation experiments at LLNL within the liquefied gaseous-fuels spill-safety program
[DE82-010729] p 103 N83-17651

GAS FLOW

- Entrained flow, ablative fast pyrolysis of biomass
[DE82-005791] p 113 N83-18875

GAS INJECTION

- Reverse-combustion, horizontal retorting of oil shale
[DE83-000018] p 137 N83-22350

GAS MIXTURES

- Corrosion of 310 stainless steel in H₂-H₂O-H₂S gas mixtures Studies at constant temperature and fixed oxygen potential
p 90 A83-20265
- Coal gasification for stationary gas-turbine applications
[DE82-902135] p 97 N83-16553

GAS RECOVERY

- Methane hydrate gas production An assessment of conventional production technology as applied to hydrate gas recovery
[DE82-006746] p 107 N83-17742
- SRC-I solvent-refined-coal process Operation of the solvent-refined-coal pilot plant, Wilsonville, Alabama
[DE82-009931] p 137 N83-22337
- Oil and gas
p 34 A83-22674
- Recovery of gas from hydrate deposits using conventional production technology
[DE82-008106] p 145 N83-22775

GAS STREAMS

- Gas characterization from fluidized-bed coal gasification
[DE82-012396] p 138 N83-22357

GAS TRANSPORT

- Heavy Gas Dispersal
[VKI-LS-1982-03] p 200 N83-19316
- Introductory lecture Statement of the problem
p 200 N83-19317

GAS TURBINE ENGINES

- High temperature erosion and erosion-hot corrosion of superalloys and coatings
p 91 A83-21458

Radiation and smoke from the gas turbine combustor using heavy fuels
p 92 A83-23877

Catalyst durability evaluation for advanced gas turbine engines

[ASME PAPER 82-JPGG-GT-21] p 152 A83-25270

Large parabolic dish collectors with small gas-turbine, Stirling engine or photovoltaic power conversion systems
p 160 A83-27329

A method to estimate weight and dimensions of small aircraft propulsion gas turbine engines User's guide
[NASA-CR-168049] p 162 N83-16343

Coal gasification for stationary gas-turbine applications
[DE82-902135] p 97 N83-16553

The 1-MW(th) solar-thermal conversion full-system experiment
[DE82-906454] p 59 N83-16920

Advanced Gas Turbine (AGT) powertrain system development for automotive applications
[NASA-CR-167983] p 166 N83-17424

Experimental study of the thermal stability of hydrocarbon fuels
[NASA-CR-168027] p 105 N83-17728

GAS TURBINES

The design and construction of a low power gas turbine for solar energy conversion - An analytical model of operation of the installation in a variable mode - French thesis
p 52 A83-28647

A study of a solar central power plant with a gas turbine - Project Sirocco modelling and control - French thesis
p 53 A83-28652

18.1 pressure ratio axial/centrifugal compressor demonstration program
p 181 A83-29013

External combustion steam injected gas turbine
[DE82-019862] p 168 N83-19102

Flow distribution control characteristics in marine gas turbine waste-heat recovery system Phase 2 Flow distribution control in waste-heat steam generators
[AD-A119310] p 175 N83-20054

Fuel property effects on diesel engine and gas turbine combustor performance
[AD-A120879] p 175 N83-20161

Critical research and advanced technology (CRT) support project
[NASA-TM-83019] p 123 N83-20361

Engineering systems analysis of pressurized fluidized-combustion power systems
[DE82-013390] p 127 N83-21083

Centaur gas-turbine modification and development for solar-fossil hybrid operation
[DE83-900192] p 177 N83-21366

CAESCAP A computer code for compressed-air energy-storage-plant cycle analysis
[DE83-003146] p 196 N83-21528

Ceramic heat-exchanger applications study
[DE83-003166] p 132 N83-21529

Enriched-air and oxygen gasification of Illinois No. 6 coal in a Texaco coal-gasification unit
[DE82-903133] p 139 N83-22362

High-temperature turbine technology program Volume 5 Materials technology development
[DE83-004330] p 181 N83-22607

Fuel quality-processing study Volume 1 Overview and results
[NASA-CR-165326-VOL-1] p 143 N83-22750

Fuel quality-processing study Volume 2 Literature survey
[NASA-CR-165326-VOL-2] p 143 N83-22751

Fuel quality/processing study Volume 3 Fuel upgrading studies
[NASA-CR-165326-VOL-3] p 144 N83-22754

GAS-LIQUID INTERACTIONS
Direct-contact air/molten salt heat exchange for solar thermal systems
p 47 A83-27234

GASEOUS DIFFUSION
Mass transfer and chemical reaction of gaseous species in non-catalytic and catalytic porous media supporting catalytic and non-catalytic liquids
[DE82-021713] p 95 N83-16427

GASEOUS FUELS
A study on the hydrogen-oxygen diffusion flame in high speed flow
p 93 A83-26199

Oil and Gas Supply Modeling
[PB82-234139] p 117 N83-19310

Dynamic simulation of sulfur-removal systems
[DE82-902074] p 119 N83-19865

GASES
Heavy Gas Dispersal
[VKI-LS-1982-03] p 200 N83-19316

Subsea permafrost in Harrison Bay, Alaska An interpretation from seismic data
[AD-A121020] p 125 N83-20479

GASIFICATION
Steam gasification of wood in the presence of catalysts
[DE82-005919] p 162 N83-16557

Methanol synthesis gas from catalytic steam reforming of wood
[DE82-006082] p 106 N83-17734

Catalyst behavior in biomass gasification - wood
[DE82-006164] p 110 N83-18057

Catalytic gasification of biomass
[DE82-005877] p 110 N83-18058

Gasification of land-based biomass
[PB83-109918] p 122 N83-19946

Catalyzed steam gasification of biomass Phase 3 Biomass Process Development Unit (PDU) construction and initial operation
[DE82-010264] p 124 N83-20415

Continuously adjustable low-power gasifier burner/boiler system
[BMFT-FB-T-82-038] p 131 N83-21507

Marine biomass New York state site and species study compositional analysis and systems studies
[PB83-126078] p 142 N83-22470

GASOLIN (FUEL)

Demonstration of modification of a gasoline spark-ignited engine to permit using ethanol as a fuel
[DE83-001384] p 114 N83-19101

Devising efficient biotechnological processes for the production of fuels and chemicals from biomass
[DE82-017089] p 124 N83-20418

A study of possible detrimental effects on internal combustion engines by the combustion of gasohol blends
[CSIR-ME-446] p 129 N83-21166

The engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc at Thibodaux, Louisiana Attachment A Volume 2 Definition of facilities and scope of work for an ethanol facility to be located at Thibodaux, Louisiana
[DE83-001165] p 147 N83-22829

GASOLINE

The properties of fuel fractions obtained by the hydrogenation of Kansai-Achinsk coal
p 94 A83-26920

Possibilities of improving exhaust emissions and energy consumption in mixed hydrogen-gasoline operation
p 87 A83-27334

Trends in motor gasolines, 1942 - 1981
[DE82-021124] p 96 N83-16550

Process engineering and mechanical design reports Volume 1 Preliminary design and assessment of a 50,000 BPD coal-to-methanol-to-gasoline plant
[DE83-000848] p 97 N83-16559

Fuel-composition and -vaporization effects on combustion-chamber deposits
[DE82-012576] p 104 N83-17670

Motor gasolines, summer 1981
[DE82-014425] p 121 N83-19924

Fleet experience using a methanol/unleaded gasoline blend
[DE83-003834] p 129 N83-21171

Refining studies and engine testing of alternative highway-transportation fuels Identification and evaluation of optimized alternative fuels
[DE83-003332] p 129 N83-21172

Continuously adjustable low-power gasifier burner/boiler system
[BMFT-FB-T-82-038] p 131 N83-21507

Motor-fuels for road vehicles
[REPT-24] p 140 N83-22440

Aviation Gasolines and Future Alternatives
[NASA-CP-2267] p 140 N83-22442

Manufacturing comparisons of aviation and motor gasolines
p 141 N83-22448

Underground Coal Gasification (UCG) gas to methanol and MTG-gasoline An economic and sensitivity study, task B
[DE83-004320] p 146 N83-22821

Annual Transportation Convention, volume 2 Session F Energy and Transportation Engineering Session G Transport Planning
[CSIR-S-313-VOL-2] p 37 N83-23212

Gasoline shortfall management
p 148 N83-23213

Characterization of exhaust emissions from methanol- and gasoline-fueled automobiles
[PB83-116830] p 149 N83-23249

GENERAL AVIATION AIRCRAFT
General aviation airplane fuel economy system model
p 20 N83-18647

Industry's assessment of the number of airplanes in the general aviation fleet along with their hours flown and fuel consumption data powered by what type of engines, when and for what reasons, through the year 2000
p 140 N83-22445

GENETIC ENGINEERING
West Europe report Science and technology, no 134
[JPRS-82686] p 199 N83-17761

The utilization of emergent aquatic plants for biomass-energy-systems development
[DE82-009174] p 124 N83-20395

Devising efficient biotechnological processes for the production of fuels and chemicals from biomass
[DE82-017089] p 124 N83-20418

GEOCHEMISTRY

Geothermal resource assessment of Idaho Springs, Colorado Resource series 16
[DE83-000345] p 110 N83-18073

Application of energy dispersive X-ray fluorescence, ion sensitive electrodes and instrumental neutron activation in geochemical prospecting
[BMFT-FB-T-82-152] p 111 N83-18123

Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197

Geothermal energy resource assessment of parts of Alaska
[DE83-000140] p 116 N83-19299

Geotoxic materials in the surface environment
[DE82-005855] p 23 N83-19333

Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703

Workshop report on Basic Research in Organic Geochemistry Applied to National Energy Needs
[DE82-007074] p 144 N83-22760

Summary of recommendations on basic research
p 35 N83-22761

Exploration deliberations p 144 N83-22762

Exploitation deliberations p 144 N83-22763

Problems in organic geochemistry applied to petroleum exploration and production p 144 N83-22765

Utilization of oil shales and basic research in organic geochemistry p 144 N83-22766

The relevance of coal geochemistry to coal utilization p 144 N83-22767

Conversion of coal to synthetic fuels p 144 N83-22768

GEOLOGICAL FAULTS

NNE-SSW fault system in part of the Gulf of Suez and its bearing on oil exploration p 92 A83-24551

A study of the United States coal resources
[NASA-CR-169792] p 101 N83-16993

Geothermal resource assessment of Idaho Springs, Colorado Resource series 16
[DE83-000345] p 110 N83-18073

High resolution seismic survey of the Hanna, Wyoming underground coal gasification area
[DE82-006887] p 112 N83-18137

GEOLOGICAL SURVEYS

Hydrogeologic studies abroad --- Russian book
p 92 A83-25247

Results of the investigation of the oil and gas deposits of Tadzhikistan on the basis of space photographs
p 94 A83-26805

Geothermal resource assessment in Oklahoma
[DE82-021288] p 100 N83-16874

High resolution seismic survey of the Hanna, Wyoming underground coal gasification area
[DE82-006887] p 112 N83-18137

PLTSYM A FORTRAN computer system to plot Canadian symbol location maps for hydrogeochemical and stream-sediment reconnaissance data
[DE83-000764] p 123 N83-20337

Geothermal p 143 N83-22678

A geologic study of the Michigan Basin
[PB83-136291] p 147 N83-22896

A geologic study of the Black Warrior Basin
[PB83-136283] p 147 N83-22904

GEOLOGY

Perspectives in Geology Invited papers presented at a symposium in observance of the 75th anniversary of the Illinois State Geological Survey
[PB-255589] p 112 N83-18138

The Illinois State Geological Survey The next quarter century p 112 N83-18139

Coal geology Who needs it? p 112 N83-18140

Preliminary geothermal evaluation of the Mokapu Peninsula on the Island of Oahu, Hawaii
[AD-A119158] p 117 N83-19378

Colado geothermal resource assessment Shallow-hole temperature survey Intermediate-depth holes IGH no 1 and no 2, Depth test hole 44X-10
[DE83-002898] p 135 N83-21621

Exploration deliberations p 144 N83-22762

Exploitation deliberations p 144 N83-22763

Assessment of the geothermal resources of Kansas
[DE83-003234] p 145 N83-22790

A geologic study of the Raton Basin
[PB83-136275] p 147 N83-22903

GEOMAGNETISM

Interpolation and transformations of maps --- French thesis
p 94 A83-28632

GEOMETRICAL OPTICS

Design of antireflection coatings for textured silicon solar cells
p 52 A83-27983

GEOMORPHOLOGY

Structural geomorphology of Rajasthan basin, India-interpreted through Landsat imagery and aerial photos
p 92 A83-24626

GEOPHYSICAL OBSERVATORIES

A brief overview of geophysical probing technology
[DE82-011217] p 19 N83-18133

GEOPHYSICS

First results, problems of French deep gasification program
p 107 N83-17765

A brief overview of geophysical probing technology
[DE82-011217] p 19 N83-18133

Geothermal energy resource assessment of parts of Alaska
[DE83-000140] p 116 N83-19299

Heat flow and geothermal potential of Kansas
[DE83-003235] p 134 N83-21609

GEOPRESSURE

The variable pressure supercritical Rankine cycle for integrated natural gas and power production from the geopressed geothermal resource
[DE82-008957] p 179 N83-21591

A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas
[DE83-004095] p 135 N83-21686

GEOTECHNICAL ENGINEERING

Geotechnical properties of PARAHO spent shale
[DE83-002633] p 136 N83-21694

Geotechnical basis for underground energy storage in hard rock
[DE82-903307] p 198 N83-22836

GEOTEMPERATURE

Oxygen isotope exchange in rocks and minerals from the Cerro Prieto geothermal system Indicators of temperature distribution and fluid flow
[DE82-001077] p 100 N83-16907

Heat flow and geothermal potential of Kansas
[DE83-003235] p 134 N83-21609

GEOTHERMAL ENERGY CONVERSION

Sperry low-temperature geothermal conversion system
Volume 1 Organic-working-fluid properties
[DE82-018529] p 163 N83-16867

Analyses of mixed hydrocarbon binary thermodynamic cycles for moderate temperature geothermal resources
[DE82-006272] p 164 N83-16904

Health and safety issues of alternate energy systems
[DE82-002918] p 9 N83-16959

Proceedings of the Fifth Annual Geothermal Conference and Workshop
[DE82-901295] p 110 N83-18052

Localized corrosion in materials for geothermal power
[DE82-015608] p 128 N83-21136

Integration of hydrothermal-energy economics Related quantitative studies
[DE83-001407] p 178 N83-21544

GEOTHERMAL ENERGY EXTRACTION

Oxygen isotope exchange in rocks and minerals from the Cerro Prieto geothermal system Indicators of temperature distribution and fluid flow
[DE82-001077] p 100 N83-16907

Investigation of the geothermal potential of the UK The Southampton (Western Esplanade) geothermal well A preliminary assessment of the resource
p 109 N83-18029

A preliminary plan for the development of geothermal energy in the town of Gabbs, Nevada
[DE82-007602] p 17 N83-18064

Decision framework for technology choice Volume 1
A case study of one utility's coal-nuclear choice
[DE82-902213] p 113 N83-18554

GEOTHERMAL ENERGY UTILIZATION

User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 1 Main text
[DE82-022512] p 99 N83-16865

User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 2 Appendices
[DE82-022511] p 99 N83-16866

Performance and operational experience of a prototype binary geothermal power plant
[DE82-006289] p 164 N83-16901

Investigation of the geothermal potential of the UK The Southampton (Western Esplanade) geothermal well A preliminary assessment of the resource
p 109 N83-18029

A preliminary plan for the development of geothermal energy in the town of Hawthorne, Nevada
[DE82-007594] p 17 N83-18065

Geothermal energy Opportunities for California commerce, phase 1 report
[DE82-009121] p 110 N83-18066

Multiple-task services for the Division of Geothermal Energy's hydrothermal-resources program
[DE82-009007] p 110 N83-18070

Real time sensors in geothermal fluids, their costs and benefits
[DE82-014857] p 130 N83-21328

Mathematical modeling of the behavior of geothermal systems under exploitation
[DE82-010925] p 133 N83-21587

National forecast for geothermal resource exploration and development with techniques for policy analysis and resource assessment
[DE82-014641] p 133 N83-21588

Geothermal feasibility study for City of Sonoma, California four municipal buildings
[DE82-015115] p 133 N83-21589

Geothermal heating facilities for Frontier Inn, Susanville, California
[DE82-015114] p 134 N83-21590

Utilization of warm well water, eastern Washington state
[DE82-015101] p 134 N83-21594

Geothermal-heating facilities for Carson Elementary School and Wind River Middle School
[DE82-015121] p 134 N83-21595

Geothermal Direct Heat Program Roundup, volume 1
[DE82-019912] p 135 N83-21628

Evaluation of ammonia as a working fluid for a wet/dry-cooled binary geothermal plant
[DE83-002895] p 135 N83-21631

Reinjection and injection of fluids in geothermal operations (state of the art)
[DE83-001857] p 135 N83-21632

Use of hot-dry-rock geothermal resources for space heating A case study
[DE83-002947] p 135 N83-21636

Irrigation pumping using geothermal energy
[DE83-005308] p 135 N83-21641

Vertical sampling flights in support of the 1981 ASCOT cooling tower experiments Field effort and data
[DE82-014269] p 135 N83-21661

Energy resources in New Mexico Oil and gas, coal, electrical generation, uranium, and geothermal energy
[DE83-900485] p 142 N83-22672

Geothermal methods for evaluating the DOE
Appropriate-Technology Program A review and compilation of evaluation methods
[DE83-003306] p 145 N83-22781

Geothermal Energy Tomorrow's Alternative Today A handbook for geothermal-energy development in Delaware
[DE83-002987] p 35 N83-22782

Perspective on our energy options
[DE82-005828] p 36 N83-22802

Issues affecting storage of compressed air in solution-mined salt cavities
[DE83-002017] p 197 N83-22804

Geothermal Energy, Opportunities for California Business A two-day Conference on Direct Utilization of Geothermal Energy
[DE82-012553] p 147 N83-22826

GEOTHERMAL RESOURCES

Main advances and needs on the study of geothermal resources in Chile by using remote sensing techniques
p 91 A83-21946

Use of remote sensing techniques to study geothermal resources in and and semi-and zones in Chile
p 92 A83-24577

Advanced thermal-sensor-system development via shuttle sortie missions
[DE82-004932] p 98 N83-16834

Geothermal resource assessment in Oklahoma
[DE82-021288] p 100 N83-16874

Analyses of mixed hydrocarbon binary thermodynamic cycles for moderate temperature geothermal resources
[DE82-006272] p 164 N83-16904

Oxygen isotope exchange in rocks and minerals from the Cerro Prieto geothermal system Indicators of temperature distribution and fluid flow
[DE82-001077] p 100 N83-16907

Lithology and hydrothermal alteration determination from well logs for the Cerro Prieto Wells, Mexico
[DE82-004677] p 101 N83-17000

A preliminary plan for the development of geothermal energy in the town of Gabbs, Nevada
[DE82-007602] p 17 N83-18064

A preliminary plan for the development of geothermal energy in the town of Hawthorne, Nevada
[DE82-007594] p 17 N83-18065

Geothermal resource assessment of Idaho Springs, Colorado Resource series 16
[DE83-000345] p 110 N83-18073

Geothermal energy resource assessment of parts of Alaska
[DE83-000140] p 116 N83-19299

High-temperature geothermal cableheads
[DE82-005864] p 117 N83-19302

Preliminary geothermal evaluation of the Mokapu Peninsula on the island of Oahu, Hawaii
[AD-A119158] p 117 N83-19378

Geothermal data for 95 thermal and nonthermal waters of the Valles Caldera, southern Jemez Mountains region, New Mexico
[DE82-017397] p 130 N83-21496

Geothermal potential of Ascension Island, south Atlantic Phase 1 Preliminary examination
[DE83-004066] p 132 N83-21523

Geothermal energy in Nevada Development and utilization
[DE83-001783] p 31 N83-21545

National forecast for geothermal resource exploration and development with techniques for policy analysis and resource assessment
[DE82-014641] p 133 N83-21588

The vanable pressure supercritical Rankine cycle for integrated natural gas and power production from the geopressed geothermal resource
[DE82-008957] p 179 N83-21591

Heat flow and geothermal potential of Kansas
[DE83-003235] p 134 N83-21609

Colado geothermal resource assessment Shallow-hole temperature survey Intermediate-depth holes IGH no 1 and no 2, Depth test hole 44X-10
[DE83-002898] p 135 N83-21621

A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas
[DE83-004095] p 135 N83-21686

Regional interpretation of Kansas aeromagnetic data
[DE83-003219] p 136 N83-21701

Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703

Assessment of the geothermal resources of Kansas Volume 2. Appendices, section 3
[DE83-003222] p 143 N83-22697

Assessment of the geothermal resources of Kansas Volume 2. Appendices, section 4
[DE83-003215] p 143 N83-22698

Low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington
[DE83-001433] p 145 N83-22789

Assessment of the geothermal resources of Kansas
[DE83-003234] p 145 N83-22790

GEOTHERMAL TECHNOLOGY

A preliminary plan for the development of geothermal energy in the town of Hawthorne, Nevada
[DE82-007594] p 17 N83-18065

Monitoring well systems in geothermal areas
[DE82-012770] p 133 N83-21586

Mathematical modeling of the behavior of geothermal systems under exploitation
[DE82-010925] p 133 N83-21587

Geothermal greenhouse heating facilities for the Klamath County Nursing Home, Klamath Falls, Oregon
[DE82-015104] p 134 N83-21592

Utilization of warm well water, eastern Washington state
[DE82-015101] p 134 N83-21594

Geothermal Energy Tomorrow's Alternative Today A handbook for geothermal-energy development in Delaware
[DE83-002987] p 35 N83-22782

Geothermal Energy, Opportunities for California Business A two-day Conference on Direct Utilization of Geothermal Energy
[DE82-012553] p 147 N83-22826

GERMANIUM OXIDES

Photoelectrochemical processes in bismuth germanium oxide, Br12GeO20 single crystals p 38 N83-20581

GLASS

Industrial technology for economic and viable encapsulation for large solar panels
[PB82-259839] p 59 N83-16936

Chalcogenide-glass solar cells
[DE82-021243] p 68 N83-20382

Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures
[AD-A113883] p 72 N83-20802

Stress analysis of spherical mirror panels
[DE82-015656] p 77 N83-21585

GLASS FIBER REINFORCED PLASTICS

Compression molded energy storage flywheels
p 189 N83-27303

Fiberglass composite blades for the 4 MW - WTS-4 wind turbine
p 170 N83-19243

GLASS FIBERS

Design and evaluation of low-cost stainless steel fiberglass foam blades for large wind driven generating systems
[NASA-CR-165491] p 169 N83-19226

Fatigue testing of low-cost fiberglass composite wind turbine blade materials
[NASA-CR-165566] p 181 N83-22746

GOVERNMENT/INDUSTRY RELATIONS

The role of business incentives in the development of renewable energy technologies
[GPO-99-651] p 25 N83-20364

Industry/Government Forum on Recent Policy and Budget Changes in the DOE Solar-Thermal Program
[DE82-012511] p 36 N83-22801

GRAIN BOUNDARIES

Grain boundary effects in polycrystalline silicon solar cells I - Solution of the three-dimensional diffusion equation by the Green's function method II - Numerical calculation of the limiting parameters and maximum efficiency
[DE82-004662] p 52 N83-27981

Influence of grain boundaries on solar cell performance
[DE82-006118] p 56 N83-16881

Effects of grain boundaries in GaAs solar cells
[DE82-006118] p 61 N83-18059

The structure of 110 tilt boundaries in large area solar silicon
[NASA-CR-170204] p 81 N83-22744

GRAPHITE-EPOXY COMPOSITES

Study on composite flywheels for energy storage
p 188 N83-22701

Twin disk composite flywheel
p 189 N83-27304

GRAVIMETRY

NNE-SSW fault system in part of the Gulf of Suez and its bearing on oil exploration
p 92 N83-24551

Interpolation and transformations of maps -- French thesis
p 94 N83-28632

Fossil energy
[DE83-003817] p 124 N83-20383

GRAVITATION

Geothermal energy resource assessment of parts of Alaska
[DE83-000140] p 116 N83-19299

GRAVITATIONAL EFFECTS

Heavy Gas Dispersal
[VKI-LS-1982-03] p 200 N83-19316

Identification of problem areas related to the dispersion of heavy gases
p 200 N83-19318

GREAT LAKES (NORTH AMERICA)

A geologic study of the Michigan Basin
[PB83-136291] p 147 N83-22896

GREEN FUNCTION

Grain boundary effects in polycrystalline silicon solar cells I - Solution of the three-dimensional diffusion equation by the Green's function method II - Numerical calculation of the limiting parameters and maximum efficiency
p 52 N83-27981

GREENHOUSE EFFECT

Feedback mechanisms in the climate system affecting future levels of carbon dioxide
p 2 N83-24252

GREENHOUSES

Annual thermal performance of sunspace-type passive-solar collectors for residence heating Attached and semi-enclosed geometries
[DE83-002310] p 56 N83-16888

Contemporary Systems, Inc., Walpole, New Hampshire solar-energy-system performance evaluation
[DE83-000068] p 57 N83-16894

Geothermal greenhouse heating facilities for the Klamath County Nursing Home, Klamath Falls, Oregon
[DE82-015104] p 134 N83-21592

GRIDS

On-site fuel cell field test support program
[PB83-121723] p 28 N83-20439

GRINDING (COMMINUTION)

Volatile production during preignition coal heating
[DE82-011241] p 95 N83-16445

Ultrasonically enhanced size reduction of coal
[DE82-008679] p 113 N83-18416

Particulate processes in pulverized-coal flames
[DE82-014306] p 140 N83-22367

GROUND SUPPORT EQUIPMENT

Implementation of R & QA practices in Research and Development programs
[NASA-TM-82997] p 24 N83-19651

GROUND WATER

Hydrogeologic studies abroad -- Russian book
p 92 N83-25247

Chemical characterization of organic contaminants in groundwater near an underground coal gasification site
[DE82-004822] p 8 N83-16956

Cleanup of groundwater contaminated by underground coal gasification
[DE82-005824] p 19 N83-18118

Geothermal data for 95 thermal and nonthermal waters of the Valles Caldera, southern Jemez Mountains region, New Mexico
[DE82-017397] p 130 N83-21496

Use of twin wells and water-source heat pumps for energy conservation in Louisiana
[DE83-900349] p 32 N83-21610

Irrigation pumping using geothermal energy
[DE83-005308] p 135 N83-21641

Future landscapes of the Colorado plateau Impacts of energy development
[DE83-900473] p 34 N83-21666

Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703

Low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington
[DE83-001433] p 145 N83-22789

GROUND WIND

Convective heat losses from flat-plate solar collectors in turbulent winds
p 43 N83-23883

GUARDS (SHIELDS)

Hail impact testing procedure for solar collector covers
[PB83-104745] p 84 N83-22841

GUIDANCE SENSORS

Design of highwall mining equipment electronic guidance package
[DE82-006115] p 108 N83-18005

H

HABITATS

Examination of tidal flats Volume 3 Evaluation methodology
[PB83-131805] p 148 N83-22949

HALL EFFECT

Hall-Field limitations in MDH generators
[DE83-001149] p 177 N83-21246

HAULING

Collection, transportation, and storage of biomass residues in the Pacific Northwest
[DE82-004737] p 100 N83-16887

HAWAII

The 80 megawatt wind power project at Kahuku Point, Hawaii
p 172 N83-19264

Preliminary geothermal evaluation of the Mokapu Peninsula on the island of Oahu, Hawaii
[AD-A119158] p 117 N83-19378

HAZARDS

Recent flame-propagation experiments at LLNL within the liquefied gaseous-fuels spill-safety program
[DE82-010729] p 103 N83-17651

Manufacture, distribution, and handling of nitrate salts for solar-thermal applications
[DE83-003317] p 79 N83-21625

HEALTH

Health and environmental effects document for batteries, 1981 The zinc/halogen batteries
[DE82-006987] p 23 N83-19331

HEALTH PHYSICS

Is nuclear energy an unacceptable hazard to health?
[DE82-004954] p 9 N83-16961

Manufacture, distribution, and handling of nitrate salts for solar-thermal applications
[DE83-003317] p 79 N83-21625

Toxicology of coal gasification Chemical characterization
p 148 N83-22960

HEAT BALANCE

Liquid-phase methanol process development unit Installation, operation, and support studies
[DE82-012725] p 121 N83-19940

HEAT EXCHANGERS

Transient analysis of a natural circulation solar water heater with a heat exchanger
p 41 N83-23129

Thermal control - Heat buses will operate like a public utility
p 184 N83-24358

Direct-contact air/molten salt heat exchange for solar thermal systems
p 47 N83-27234

Back-to-back test for determining the pumping losses in a Stirling cycle machine
p 158 N83-27290

Optimal heat pumps for solar-assisted heat-pump systems
[DE82-004798] p 55 N83-16688

Organic rankine cycle coupled to a solar pond by direct-contact heat exchange - selection of a working fluid
[DE82-020998] p 57 N83-16900

Development of heat exchangers for reheating scrubbed flue gas in a pilot plant
[BMFT-FB-T-82-169] p 13 N83-17840

Testing of heat exchanger systems for reheating flue gases from wet scrubbing desulfurization plants
[BMFT-FB-T-82-170] p 13 N83-17841

Potential for domestic heat recovery
[DE82-901395] p 15 N83-18037

Opportunities for direct-contact waste heat recuperators for industrial heat recovery
[DE82-006280] p 15 N83-18038

Metal hydride/chemical heat-pump development project, phase 1
[DE83-002463] p 27 N83-20429

CAESCAP A computer code for compressed-air energy-storage-plant cycle analysis
[DE83-003146] p 186 N83-21528

- Ceramic heat-exchanger applications study
[DE83-003166] p 132 N83-21529
- A 10-MWe solar-thermal central-receiver pilot plant
Solar facilities design integration Plant operating/training
manual (RADL-Item 2-36) p 75 N83-21551
- Additional testing of the passive heat-pipe-cooled solar
photovoltaic receiver
[DE-83-004474] p 78 N83-21615
- Residential air-to-air heat exchangers A study of the
ventilation efficiencies of wall- or window-mounted units
[DE83-004752] p 33 N83-21617
- Design approaches for solar industrial process-heat
systems Nontracking and line-focus collector
technologies
[DE83-003339] p 79 N83-21620

HEAT GENERATION

- Cogeneration using a thermionic combustor
p 159 A83-27300
- Biomass cogeneration A business assessment
[DE82-011773] p 101 N83-16928
- Construction and operation of a central heating plant
prototype heated by coal dust corresponding to the
Schoppe system
[BMFT-FB-T-82-176] p 109 N83-18031
- Thermal-receiver designs for line-focus solar
collectors
[DE82-012067] p 82 N83-22777

HEAT PIPES

- The results of an experimental investigation of the effect
of vibration loading parameters on the working
characteristics of heat pipes p 184 A83-23924
- Thermal control - Heat buses will operate like a public
utility p 184 A83-24358
- A heat pipe simulation technique for spacecraft thermal
testing under variable orientation
[SAE PAPER 820860] p 185 A83-25760
- Long titanium heat pipes for high-temperature space
radiators p 185 A83-27127
- Artery heat pipes for space power systems
p 185 A83-27128
- Development of high-temperature liquid metal heat pipes
for isothermal irradiation assemblies --- for in-pile tests
of UO₂ space reactor fuel configurations p 185 A83-27129
- A concept of heat pipe engine p 154 A83-27208
- U K Consortium Stirling engine programme
p 157 A83-27285
- Direct-energy-conversion implications of space nuclear
reactors p 159 A83-27297
- Thermionic technology infrastructure for space power
p 159 A83-27298
- A method for producing heat pipes for cooling
semiconductor photovoltaic cells and the heat pipe
characteristics p 52 A83-28366
- Research needs Prime-power for high energy space
systems p 163 N83-16861
- Heat pipes containing alkali metal working fluid
[NASA-CASE-LEW-12253-1] p 186 N83-19596
- Analytical and experimental investigations of sodium
heat pipes and thermal energy storage systems
[AD-A122093] p 195 N83-20375
- Additional testing of the passive heat-pipe-cooled solar
photovoltaic receiver
[DE-83-004474] p 78 N83-21615
- Design, fabrication and test of liquid metal heat-pipe
sandwich panels
[NASA-TM-84631] p 187 N83-22541

HEAT PUMPS

- Metal hydride heat pump p 3 A83-27211
- Optimal heat pumps for solar-assisted heat-pump
systems
[DE82-004798] p 55 N83-16688
- Solar/gas Rankine/Rankine-cycle heat pump
assessment
[PB82-254863] p 55 N83-16710
- Rymark 1, Rymark 2, and Rymark 3, Fredenck, Maryland
Solar-energy-system performance evaluation, May 1981
through March 1982
[DE83-000067] p 57 N83-16890
- Research, development and demonstration of an
advanced actuated heat pump
[PB82-254590] p 164 N83-16932
- Rankine/Rankine cycle gas-fired heat pump
[PB82-254640] p 165 N83-16944
- Open-cycle vapor compression heat pump
[PB82-262569] p 8 N83-16947
- Investigation and development of systems for the
storage of thermal energy in the temperature range from
-25 deg C to +150 deg C p 193 N83-16949
- Steam ejector as an industrial heat pump
[DE82-010194] p 14 N83-17847

- Comparison of heat pump water heaters and solar
domestic water heaters
[DE82-006117] p 61 N83-18046
- Steady-state testing of an advanced solar-assisted heat
pump
[DE83-002343] p 66 N83-19297
- Solar/gas Brayton/Rankine cycle heat pump
assessment
[PB83-102319] p 67 N83-19963
- Conceptual design and performance analysis of
absorption heat pumps for waste-heat utilization
[DE82-010202] p 186 N83-20060
- Sulfuric acid/water chemical heat pump/chemical
energy storage, phases 1 and 2, phases 3 and 4
[DE83-001255] p 195 N83-20380
- Metal hydride/chemical heat-pump development
project, phase 1
[DE83-002463] p 27 N83-20429
- SRC-I project Baseline
[DE83-000987] p 127 N83-21086
- US heat-pump research and development projects
[DE83-000943] p 31 N83-21536
- User's manual for heat-pump Seasonal-Performance
Model (SPM) with selected parametric examples
[DE83-002455] p 31 N83-21552
- User's manual for steady-state computer simulation for
air-to-air heat pumps with selected examples
[DE83-002446] p 32 N83-21553
- Program listing for air-to-air heat pump steady-state
Computer-Simulation Mode (CSM)
[DE83-002549] p 32 N83-21559
- Use of twin wells and water-source heat pumps for
energy conservation in Louisiana
[DE83-000349] p 32 N83-21610
- Adiabatic absorption and desorption for improvement
of temperature-boosting adsorption heat pumps
[DE83-002589] p 33 N83-21611
- Program listing for heat-pump Seasonal-Performance
Model (SPM) p 33 N83-21612
- Solar-assisted water-source heat pump
[DE82-013981] p 81 N83-22567
- Heat-activated heat-pump development and potential
application of Stirling-engine technology
[DE83-002134] p 183 N83-22817

HEAT RESISTANT ALLOYS

- High temperature erosion and erosion-hot corrosion of
superalloys and coatings p 91 A83-21458
- Physical properties data compilations relevant to energy
storage Part 5 Mechanical properties data on alloys
for use in flywheels
[PB82-232919] p 194 N83-18904

HEAT SOURCES

- Radioisotopes for heat-source applications
[DE83-005045] p 137 N83-21934
- The Light Weight Radioisotope Heater Unit (LWRHU)
A technical description of the reference design
[DE82-014121] p 148 N83-23138
- Reentry thermal testing of a general purpose heat source
fueled clad
[DE82-014125] p 184 N83-23146
- Reentry thermal testing of light-weight radioisotope
heater unit
[DE82-014116] p 148 N83-23147

HEAT STORAGE

- Finite element analysis of mixed convection applied to
the storage of solar energy p 42 A83-23219
- Optimal control of solar heating and off-peak energy
storage installations p 42 A83-23882
- Comparison of advanced thermal and electrical storage
for parabolic dish solar thermal power systems
p 47 A83-27232
- Evaluation and application of solid thermal energy
carriers in a high temperature solar central receiver
system p 47 A83-27235
- Thermal energy storage - Air Force user considerations
in various modes of operation p 190 A83-27305
- AQUASTOR - A computer model for cost analysis of
aquifer thermal energy storage coupled with district heating
or cooling systems p 191 A83-27314
- Cost and performance of thermal storage concepts in
solar thermal systems, Phase 2-liquid metal receivers
p 51 A83-27316
- High-temperature molten salt solar thermal systems
p 51 A83-27317
- Performance of a cylindrical phase-change thermal
energy storage unit p 191 A83-28969
- Electric system impacts of storage heating and storage
water heating, part 2
[DE81-032010] p 192 N83-16863
- Design considerations in the use of Glauber salt for
energy storage
[DE82-019289] p 192 N83-16868
- Thermal performance of the Brookhaven natural thermal
storage house
[DE82-005507] p 56 N83-16879

- Gill Harrop, Big Flats, New York solar-energy-system
performance evaluation
[DE83-000065] p 57 N83-16895
- Evaluation of industrial advanced heat recovery/thermal
energy storage systems
[DE82-906475] p 193 N83-16919
- Investigation of latent heat storage materials in the
medium and high temperature range
[PB82-259896] p 193 N83-16933
- Investigation and development of systems for the
storage of thermal energy in the temperature range from
-25 deg C to +150 deg C p 193 N83-16949
- Guidelines for sampling and analyzing solutions for
aquifer thermal-energy-storage systems
[DE83-001852] p 10 N83-16973
- Cost of heat from a seasonal source
[DE82-006026] p 194 N83-18045
- High-temperature composite latent/sensible heat
storage
[DE82-010396] p 62 N83-18063
- Residential and commercial cogeneration systems
assessment
[PB82-240037] p 22 N83-19314
- Sulfuric acid/water chemical heat pump/chemical
energy storage, phases 1 and 2, phases 3 and 4
[DE83-001255] p 195 N83-20380
- New physical-chemical reactions useful for TES
[DE82-020807] p 195 N83-20432
- Solar-energy-system performance evaluation
Honeywell OTS 44, Ocmulgee, Georgia
[NASA-CR-170031] p 74 N83-21530
- Fundamental heat-transfer processes related to
phase-change thermal-storage media
[DE83-002205] p 196 N83-21639
- Energy-transmission-system heat losses
[DE83-003628] p 187 N83-22786
- Aquifer thermal-energy-storage modeling
[DE83-900672] p 197 N83-22794
- Underground energy-storage program overview
[DE83-002059] p 198 N83-22806
- Instrumentation of the Brookhaven Natural Thermal
Storage House
[DE83-000267] p 198 N83-22815

HEAT TRANSFER

- Numerical calculation of the heat transfer by natural
convection in a cubical enclosure p 42 A83-23212
- Evaluation and application of solid thermal energy
carriers in a high temperature solar central receiver
system p 47 A83-27235
- Improved Stirling engine performance using jet
impingement p 158 A83-27288
- A 2D model of turbulent solar induced flows in passive
air collectors p 53 A83-29039
- Study based on ammonia/water solutions of a district
heating transport system
[BMFT-FB-T-82-188] p 186 N83-18033
- Solar energy systems Standards for screening plastic
containment materials
[PB82-242454] p 62 N83-18921
- Heat pipes containing alkali metal working fluid
[NASA-CASE-LEW-12253-1] p 186 N83-19596
- Photovoltaic/thermal collector development program
[DE82-012572] p 71 N83-20416
- Some basic research problems related to energy
[DE83-003753] p 195 N83-21527
- Fundamental heat-transfer processes related to
phase-change thermal-storage media
[DE83-002205] p 196 N83-21639
- Solar-assisted water-source heat pump
[DE82-013981] p 81 N83-22567
- Multi-fuel low-NO_x burner development, phase 2
[PB83-126292] p 147 N83-22845

HEAT TRANSFER COEFFICIENTS

- Convective heat losses from flat-plate solar collectors
in turbulent winds p 43 A83-23883
- Heat loss coefficients and effective tau-alpha products
for flat-plate collectors with diathermanous covers
p 53 A83-28939

HEAT TRANSMISSION

- Heat flow and geothermal potential of Kansas
[DE83-003235] p 134 N83-21609
- Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703

HEAT TREATMENT

- Al-Si peaked Schottky barriers p 40 A83-22903
- The effect of the melt heat treatment time on the
properties of lithium lubricants with additives
p 94 A83-26921
- Multi-fuel low-NO_x burner development, phase 2
[PB83-126292] p 147 N83-22845
- Reentry thermal testing of a general purpose heat source
fueled clad
[DE82-014125] p 184 N83-23146

SUBJECT INDEX

HEATING

- Efficient daylighting in thermally controlled environments p 6 N83-16885
[DE82-003045]
Development of heat exchangers for reheating scrubbed flue gas in a pilot plant p 13 N83-17840
[BMFT-FB-T-82-169]
Testing of heat exchanger systems for reheating flue gases from wet scrubbing desulfurization plants p 13 N83-17841
[BMFT-FB-T-82-170]
Bi-state solid-waste-to-energy project p 28 N83-20435
[DE83-004458]
Feasibility of applications of microwave technology for nuclear power plant radioactive wastes p 29 N83-20744
[DE82-903143]
Program listing for air-to-air heat pump steady-state Computer-Simulation Mode (CSM) p 32 N83-21559
[DE83-002549]
Electric home heating Substitution for oil and gas p 133 N83-21581
[DE82-013762]
Utilization of warm well water, eastern Washington state p 134 N83-21594
[DE82-015101]

HEATING EQUIPMENT

- 1-Chart - Predictions and measurements --- of solar heating systems p 42 N83-23880
Construction and operation of a central heating plant prototype heated by coal dust corresponding to the Schoppe system p 109 N83-18031
[BMFT-FB-T-82-176]
Strategies for energy conservation in small office buildings p 22 N83-19306
[PB82-245820]
Survey of the international development in indoor climate control p 67 N83-19962
[PB83-100461]
Review of Thawtron device for thawing frozen coal p 123 N83-20330
[DE82-903145]
Evaluation of Mississippi County Community College and Northwest Mississippi Junior College solar power systems p 73 N83-21518
[DE83-004239]
Geothermal greenhouse heating facilities for the Klamath County Nursing Home, Klamath Falls, Oregon p 134 N83-21592
[DE82-015104]
The Light Weight Radioisotope Heater Unit (LWRHU) A technical description of the reference design p 148 N83-23138
[DE82-014121]
Reentry thermal testing of light-weight radioisotope heater unit p 148 N83-23147
[DE82-014116]

HEIGHT

- Vertical extrapolations of wind speed p 136 N83-21723
[DE83-000944]

HELICOPTER DESIGN

- An approach to helicopter power selection p 3 N83-24828

HELIOSTATS

- Area utilization efficiency of a sloping heliostat system for solar concentration p 39 N83-22618
Design, fabrication, and initial testing of solar one receiver p 47 N83-27229
Solar thermionic energy converter experiment p 51 N83-27301
The 5 MW for solar-chemistry development p 60 N83-18043
[DE82-002064]
Solar furnace for flux gage calibration and thermal-effects testing p 62 N83-18062
[DE82-005769]
Optical measurements p 66 N83-19567
Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field p 73 N83-21515
[DFVLR-FB-82-27]
A 10-MWe solar-thermal central-receiver pilot plant Solar facilities design integration Plant operating/training manual (RADL-Item 2-36) p 75 N83-21551
[DE83-001670]
Testing and evaluation of second-generation heliostat mirror modules p 77 N83-21582
[DE82-007934]

HEPTANES

- Shock initiated ignition in heptane-oxygen-argon mixtures p 93 N83-26198

HETEROJUNCTION DEVICES

- Effect of grain boundaries on the minority carrier diffusion length in InP solar cells p 40 N83-22908
New materials for solar cells - Tandem cells p 45 N83-26882

HIGH FREQUENCIES

- Development of High Frequency Electromagnetic Mapping (HFEM) technology p 122 N83-19998
[DE82-012773]
The HFEM monitoring of coal gasification Rawlins, Wyoming p 142 N83-22466
[DE82-013801]

HIGH RESOLUTION

- A brief overview of geophysical probing technology [DE82-011217] p 19 N83-18133

HIGH STRENGTH STEELS

- Seminar on Use of High Strength Deformed Bars [PB83-122580] p 34 N83-22486

HIGH TEMPERATURE

- Hot-gas cleanup for molten-carbonate fuel cells [DE82-002500] p 163 N83-16864
Investigation of latent heat storage materials in the medium and high temperature range [PB82-259896] p 193 N83-16933
High-temperature composite latent/sensible heat storage [DE82-010396] p 62 N83-18063
High-temperature geothermal cableheads [DE82-005864] p 117 N83-19302
Development of High Frequency Electromagnetic Mapping (HFEM) technology p 122 N83-19998
[DE82-012773]
New physical-chemical reactions useful for TES [DE82-020807] p 195 N83-20432

HIGH TEMPERATURE ENVIRONMENTS

- Long titanium heat pipes for high-temperature space radiators p 185 N83-27127
Effect of simulated medium-Btu coal gasifier atmospheres on the biaxial stress rupture behavior of four candidate coal gasifier alloys [DE82-008607] p 104 N83-17661

HIGH TEMPERATURE TESTS

- Solar receiver cavity insulation evaluation p 39 N83-22275
Thermal degradation of solar collector surfaces p 44 N83-25535
Thermionic converters for terrestrial applications p 159 N83-27299

HIGH VOLTAGES

- Assessment of research directions for high-voltage direct-current power systems p 177 N83-21247
Technology of elevated voltage solar arrays Key items test and evaluation Part 2 Simulated LEO-plasma tests [ESA-CR(P)-1646] p 73 N83-21513

HIGHWAYS

- Examination of tidal flats Volume 3 Evaluation methodology [PB83-131805] p 148 N83-22949

HINGES

- Linear static and dynamic analysis for hinged rotor blades of 60 m span for a two bladed horizontal axis wind energy converter [ISD-291] p 167 N83-18030

HISTORIES

- Energy Conservation in Historic Structures An information/awareness bulletin p 6 N83-16903
[DE82-005212]

HOLES (ELECTRON DEFICIENCIES)

- A model for the collection of minority carriers generated in the depletion region of a Schottky barrier solar cell p 40 N83-22910

HOLOGRAPHY

- Particulate processes in pulverized-coal flames [DE82-014306] p 140 N83-22367

HOMOGENIZING

- Oil/refuse homogenization An approach to combustion of refuse in existing oil-fired boilers [DE82-011848] p 138 N83-22353

HONEYCOMB STRUCTURES

- Design, fabrication and test of liquid metal heat-pipe sandwich panels [NASA-TM-84631] p 187 N83-22541

HORIZONTAL ORIENTATION

- Simplified aeroelastic modeling of horizontal axis wind turbines [NASA-CR-168109] p 178 N83-21509
Reverse-combustion, horizontal retorting of oil shale [DE83-000018] p 137 N83-22350
Some experiments on Yaw stability of wind turbines with various coning angles [NASA-CR-168108] p 181 N83-22740
Development of methodology for horizontal axis wind turbine dynamic analysis [NASA-CR-168110] p 181 N83-22747

HOSES

- Solar-collector silicon hose life test [DE83-002236] p 83 N83-22798

HOSPITALS

- Intermediate photovoltaic system application experiment operational performance report Volume 1 G N Wilcox Memorial Hospital, Kauai, Hawaii p 57 N83-16897
[DE83-000393]
Intermediate photovoltaic system experiment operational performance report Volume 3 For G N Wilcox Memorial Hospital, Kauai, Hawaii p 84 N83-22830
[DE83-000801]

HYDROCARBON FUEL PRODUCTION

HOT CORROSION

- High temperature erosion and erosion-hot corrosion of superalloys and coatings p 91 A83-21458
Critical research and advanced technology (CRT) support project [NASA-TM-83019] p 123 N83-20361
Thermal-convection-loop study of the corrosion of Fe-Ni-Cr alloys by molten NaNO₂/sub 3-KNO₃/sub 3 [DE83-004228] p 80 N83-22407

HOT ELECTRONS

- Influence of diffusion of hot carriers on collection efficiency of solar cells - a-Si:H p 42 A83-23665

HOUSINGS

- Recent advances in composite flywheel containment design technology p 189 A83-27302
Energy-storage-flywheel housing-design-concept development [DE82-014494] p 196 N83-21574

HUMAN FACTORS ENGINEERING

- Influence of driver behavior on fuel consumption Bibliographic study [IRT-58] p 11 N83-17086

HUMAN PERFORMANCE

- Influence of driver behavior on fuel consumption Bibliographic study [IRT-58] p 11 N83-17086

HUMIDITY

- Energy from humid air [DE82-017121] p 180 N83-21601

HUMIDITY MEASUREMENT

- Environmental data for sites in the National Solar Data Network [DE82-007055] p 64 N83-19280

HYBRID PROPULSION

- The relative attractiveness of electric and hybrid passenger cars p 3 A83-27159

HYBRID STRUCTURES

- Developments and applications of tantalum thin films and hybrid technology [BMFT-FB-T-82-173] p 199 N83-17686

HYDRATES

- Methane hydrate gas production An assessment of conventional production technology as applied to hydrate gas recovery [DE82-006746] p 107 N83-17742
An evaluation of hydrated calcium aluminate compounds as energy storage media [PB82-249921] p 194 N83-19308
Recovery of gas from hydrate deposits using conventional production technology [DE82-008106] p 145 N83-22775
Methane Hydrates Workshop Technical Proceedings [DE83-000580] p 147 N83-22825

HYDRAULIC EQUIPMENT

- Design of hydraulic output unit for 15 kW free-piston Stirling engine p 157 A83-27277
Hydraulic air compressor for ocean thermal energy conversion applications [DE82-005198] p 163 N83-16880
Status of DOE small hydropower research and development projects [DE83-001353] p 125 N83-20434
Analytical modeling of a hydraulically-compensated compressed-air energy-storage system [DE83-005708] p 197 N83-21640
Design of hydraulic output Stirling engine [NASA-CR-167976] p 181 N83-22739

HYDRAULIC FLUIDS

- Association-solvation characteristic of fuels and lubricating and hydraulic oils [NASA-TM-76957] p 96 N83-16525

HYDRAZINES

- The Second Conference on the Environmental Chemistry of Hydrazine Fuels [AD-A121324] p 13 N83-17731

HYDRIDES

- A system of hydrogen-powered vehicles with liquid organic hydrides p 88 A83-27340

HYDROCARBON COMBUSTION

- Effect of molecular structure on incipient soot formation p 90 A83-19847
The origin and nature of 'prompt' nitric oxide in flames p 1 A83-22344
Premixed, turbulent combustion of a sudden-expansion flow p 92 A83-23748
Experimental investigation of shock initiated methane-combustion near a wall p 93 A83-26200

HYDROCARBON FUEL PRODUCTION

- Methane synthesis on nickel by a solid-state ionic method p 91 A83-22324
Catalyst behavior in biomass gasification --- wood [DE82-006164] p 110 N83-18057
Liquefaction behavior of a Canadian subbituminous coal in comparison with several US lignites and subbituminous coals [DE82-021976] p 146 N83-22824

HYDROCARBON FUELS

Droplet size effects on NO_x/formation in a one-dimensional monodisperse spray combustion system

[ASME PAPER 82-JPGC-GT-10] p 93 A83-25268

Shock initiated ignition in heptane-oxygen-argon mixtures p 93 A83-26198

Recovery of minerals from US coals [DE82-008173] p 108 N83-18010

High performance liquid chromatographic hydrocarbon group-type analyses of mid-distillates employing fuel-derived fractions as standards [NASA-TM-83072] p 120 N83-19920

HYDROCARBONS

Association-solvation characteristic of fuels and lubricating and hydraulic oils [NASA-TM-76957] p 96 N83-16525

Analyses of mixed hydrocarbon binary thermodynamic cycles for moderate temperature geothermal resources [DE82-006272] p 164 N83-16904

Synthetic fuel effects in continuous combustion systems. An experimental study of fuel nitrogen conversion in jet-stirred combustions [DE82-002686] p 103 N83-17646

Identification and mutagenicity of nitrogen-containing polycyclic aromatic compounds in synthetic fuels [DE82-006173] p 106 N83-17739

Methane from landfills Preliminary assessment workbook [DE83-002319] p 111 N83-18075

Petroleum contamination Quantification and passive tagging in organisms and sediments [PB82-254087] p 113 N83-18880

Formation/decomposition of condensable hydrocarbons during the gasification of coal [DE82-014493] p 119 N83-19866

Photobiology task of the advanced solar energy research program [DE82-012310] p 71 N83-20417

Environmental quality research Fate of toxic jet fuel components in aquatic systems [AD-A12548] p 30 N83-21168

Problems in organic geochemistry applied to petroleum exploration and production p 144 N83-22765

HYDRODYNAMICS

First results, problems of French deep gasification program p 107 N83-17765

Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska [DE82-009666] p 115 N83-19196

Laser-plasma interaction experiments at laser wavelengths of 1.064 micron, 0.532 micron and 0.355 micron [DE82-013992] p 175 N83-20114

HYDROELECTRIC POWER STATIONS

Developments in tidal power p 155 A83-27226

Status of the 4 MW WTS-4 wind turbine p 172 N83-19263

WTS-4 system verification unit for wind/hydroelectric integration study p 173 N83-19267

Analysis of environmental issues related to small-scale hydroelectric development. 6 Dissolved oxygen concentrations below operating dams [DE82-007127] p 22 N83-19329

Definition of cost-effective river-turbine designs [DE82-010972] p 175 N83-20413

DOE small-scale hydroelectric demonstration program. F W E Stapenhorst, Inc., Goodyear Lake hydroelectric-generating-station redevelopment [DE83-003156] p 182 N83-22780

SHEBMS Small Hydroelectric Basin Modeling System [DE82-015411] p 183 N83-22832

HYDROELECTRICITY

Present and potential use of micro-hydroelectric schemes in remote locations [DE82-904687] p 26 N83-20411

Small hydro-electric potential West Poverty Bay region [DE82-905090] p 26 N83-20412

Definition of cost-effective river-turbine designs [DE82-010972] p 175 N83-20413

Status of DOE small hydropower research and development projects [DE83-001353] p 125 N83-20434

Methods for evaluating the DOE Appropriate-Technology Program A review and compilation of evaluation methods [DE83-003306] p 145 N83-22781

Geotechnical basis for underground energy storage in hard rock [DE82-903307] p 198 N83-22836

HYDROGEN

Experimental techniques for the study of photosynthetic water splitting [DE82-003974] p 89 N83-17668

Systems analysis of hydrogen supplementation in natural gas pipelines [DE82-006933] p 89 N83-17740

HYDROGEN COMPOUNDS

Optical properties of sputtered Si H [DE82-007072] p 62 N83-18491

Sulfuric acid/water chemical heat pump/chemical energy storage, phases 1 and 2, phases 3 and 4 [DE83-001255] p 195 N83-20380

HYDROGEN ENGINES

A systems analysis comparing conventional and hydrogen powered rail locomotives p 87 A83-27213

A clean internal combustion engine for underground mining machinery A technical assessment and program plan, phase 1 [PB82-244724] p 89 N83-19104

HYDROGEN FUELS

Laminar burning velocities of hydrogen-air and hydrogen-air-steam flames p 85 A83-19837

Laser fluorescence measurements of the OH concentration in a combustion boundary layer p 86 A83-24367

Using a global hydrogen-air combustion model in turbulent reacting flow calculations p 86 A83-24667

A viable process for producing hydrogen syngas using nuclear fusion heat p 87 A83-27210

Is LH2 the high cost option for aircraft fuel p 87 A83-27215

Modeling and evaluation of designs for solid hydrogen storage beds p 87 A83-27333

Possibilities of improving exhaust emissions and energy consumption in mixed hydrogen-gasoline operation p 87 A83-27334

West Europe report Science and technology, no 133 [JPRS-82608] p 89 N83-17757

LPG, hydrogen Automobile fuels of tomorrow discussed p 89 N83-17758

Combustion engine system [NASA-CASE-NPO-14565-2] p 89 N83-19826

Safe handling and testing of alternative fuels [DE82-009176] p 89 N83-21183

Study of net soot formation in hydrocarbon reforming for hydrogen fuel cells [DE83-001046] p 90 N83-22352

HYDROGEN OXYGEN FUEL CELLS

Fuel cell electrolyte for portable electrical generating equipment [AD-A121176] p 174 N83-19275

Prospects for the development of non-noble metal catalysts for hydrogen-air fuel cells [DE82-013875] p 178 N83-20422

HYDROGEN PRODUCTION

The photoreduction of water - A study of a model system - French thesis p 86 A83-22083

Present status of R&D for hydrogen production from water in Japan p 86 A83-23701

On-site production of electrolytic hydrogen for generator cooling p 86 A83-27209

A viable process for producing hydrogen syngas using nuclear fusion heat p 87 A83-27210

Current research in advanced water electrolysis in the United States and abroad p 87 A83-27216

Clean-up and processing of coal-derived gas for hydrogen applications p 87 A83-27336

Applications of ion beam technology [NASA-CR-169797] p 88 N83-16493

HYFIRE A Tokamak/high-temperature electrolysis system [DE82-004806] p 88 N83-17323

Status report on sulfur iodine thermochemical water-splitting cycle [DE82-007164] p 88 N83-17633

Status of the cadmium thermoelectrochemical hydrogen cycle [DE83-900088] p 89 N83-22349

Hydrogen use in a rural Alaskan community [DE83-000568] p 90 N83-22813

HYFIRE A Tokamak/high-temperature electrolysis system [DE82-013851] p 90 N83-23173

HYDROGEN SULFIDE

The equilibrium constant for the reversible reaction H₂S + 3H₂O_g /LiO 66K0 34/2 CO₃ yields 4H₂ + CO₂ + /LiO 66K0 34/2 SO₄ at elevated temperature --- in molten carbonate fuel cells p 150 A83-20590

Localized corrosion in materials for geothermal power [DE82-015608] p 128 N83-21136

Review of hot-gas-desulfurization simulation models [DE82-016265] p 138 N83-22356

HYDROGEN-BASED ENERGY

Storing energy in metal hydrides - A review of the physical metallurgy p 188 A83-21562

Present status of R&D for hydrogen production from water in Japan p 86 A83-23701

Theory of the computer code RET 1 for the calculation of space-time dependent temperature and composition properties of metal hydride hydrogen storage beds p 88 A83-27337

Porous metal hydride compacts - Preparation, properties and use p 88 A83-27338

Magnesium for hydrogen storage p 88 A83-27339

A system of hydrogen-powered vehicles with liquid organic hydrides p 88 A83-27340

HYDROGENATION

Amorphous silicon photovoltaic modules p 45 A83-26064

The properties of fuel fractions obtained by the hydrogenation of Kansk-Achinsk coal p 94 A83-26920

Magnesium for hydrogen storage p 88 A83-27339

Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels [PB82-255167] p 96 N83-16459

Mechanisms and kinetics of coal hydrogenation [DE82-012338] p 105 N83-17677

Extraction of coal with solvents in liquid and supercritical state under nonhydrogenating and hydrogenating conditions [BMFT-FB-T-82-177] p 109 N83-18032

EDS coal-liquefaction process development, phase 5 [DE82-012444] p 118 N83-19862

Chemistry and catalysis of coal liquefaction Catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels [DE82-012474] p 119 N83-19870

Pipeline gas from coal Hydrogenation (IGT hydrogasification process) [DE82-014611] p 121 N83-19941

Fundamental research on Fischer-Tropsch synthesis [BMFT-FB-T-82-020] p 125 N83-21052

Enlargement of the raw material basis of refineries by including hard coal Pilot plant for coal hydrogenation, construction phase [BMFT-FB-I-82-192] p 126 N83-21054

Catalytic hydrogenation of coal-derived liquids [DE83-003582] p 126 N83-21068

SR-C solvent-refined-coal process Operation of the solvent-refined-coal pilot plant, Wilsonville, Alabama [DE82-009931] p 137 N83-22337

Catalytic hydrogenation unit studies [DE83-003390] p 137 N83-22342

HYDROGEOLOGY

Hydrogeologic studies abroad --- Russian book p 92 A83-25247

Uranium hydrogeochemical and stream sediment reconnaissance of the St Michael NTMS quadrangle, Alaska [DE82-009999] p 99 N83-16844

Investigation of the geothermal potential of the UK The Southampton (Western Esplanade) geothermal well A preliminary assessment of the resource p 109 N83-18029

Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska [DE82-009666] p 115 N83-19196

HYDROLOGY

Western oil-shale development, a technology assessment Volume 6 Oil-shale development in the Piceance Creek Basin and potential water-quality changes [DE82-005659] p 108 N83-18009

Geothermal resource assessment of Idaho Springs, Colorado Resource series 16 [DE83-000345] p 110 N83-18073

Perspectives in Geology Invited papers presented at a symposium in observance of the 75th anniversary of the Illinois State Geological Survey [PB-255589] p 112 N83-18138

Low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington [DE83-001433] p 145 N83-22789

HYDROLOGY MODELS

SHEBMS Small Hydroelectric Basin Modeling System [DE82-015411] p 183 N83-22832

HYDROLYSIS

Municipal-solid-waste biconversion technologies [DE83-000263] p 100 N83-16893

Fundamental research on Fischer-Tropsch synthesis [BMFT-FB-T-82-020] p 125 N83-21052

Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery [DE82-008705] p 140 N83-22436

HYDROMETEOROLOGY

Geothermal data for 95 thermal and nonthermal waters of the Valles Caldera, southern Jemez Mountains region, New Mexico
[DE82-017397] p 130 N83-21496

HYDROLYSIS

Partial liquefaction of coal by flash hydrolysis
[DE83-001145] p 126 N83-21077
Partial liquefaction of coal by flash hydrolysis, phase 4
[DE83-002167] p 127 N83-21085

HYDROTHERMAL SYSTEMS

Lithology and hydrothermal alteration determination from well logs for the Cerro Prieto Wells, Mexico
[DE82-004677] p 101 N83-17000
Geothermal data for 95 thermal and nonthermal waters of the Valles Caldera, southern Jemez Mountains region, New Mexico
[DE82-017397] p 130 N83-21496
Integration of hydrothermal-energy economics Related quantitative studies
[DE83-001407] p 178 N83-21544
Geothermal
p 143 N83-22678

HYDROXIDES

Status of the cadmium thermoelectrochemical hydrogen cycle
[DE83-900088] p 89 N83-22349

HYDROXYL RADICALS

Laser fluorescence measurements of the OH concentration in a combustion boundary layer
p 86 A83-24367

HYGIENE

A physiological and hygienic evaluation of the work regime of operators who are working in current energy production in Kirghizia
p 4 A83-28765

HYSTERESIS

Power factor controllers p 80 N83-22510

ICE

Hail impact testing procedure for solar collector covers
[PB83-104745] p 84 N83-22841

IGNITION

Shock initiated ignition in heptane-oxygen-argon mixtures p 93 A83-26198
Anti-misting additives for jet fuels
[NASA-CR-169751] p 94 N83-16417
Ignition sources of LNG vapor clouds
[PB82-262577] p 96 N83-16461
Implementation of R & QA practices in Research and Development programs
[NASA-TM-82997] p 24 N83-19651
Combustion of oil on water: An experimental program
[DE82-014598] p 127 N83-21084
Review of alternative fuels data bases
[NASA-CR-170203] p 140 N83-22439

ILLUMINATING

Performance evaluation manual for submetered data collection
[DE82-011223] p 70 N83-20402

IMAGE ENHANCEMENT

ERRSAC contributions to the search for Appalachian hydrocarbons p 114 N83-19155

IMAGE PROCESSING

ERRSAC contributions to the search for Appalachian hydrocarbons p 114 N83-19155

IMAGING TECHNIQUES

Spray combustion processes - A review
[ASME PAPER 82-WA/HT-86] p 93 A83-25691

IMPACT

Passive-Solar Commercial Buildings Program, 1980 - 1982
[DE82-012472] p 72 N83-21202

IMPACT RESISTANCE

Hail impact testing procedure for solar collector covers
[PB83-104745] p 84 N83-22841

IMPURITIES

Clean-up and processing of coal-derived gas for hydrogen applications p 87 A83-27336
Effects of grain boundaries in GaAs solar cells
[DE82-006118] p 61 N83-18059

IN-FLIGHT MONITORING

The MCA method, a flight test technique to determine the thrust of jet aircraft in flight --- Mass Consumption Acceleration p 1 A83-19661
Computerized engine and airplane performance monitoring programs p 12 N83-17465

INCENTIVES

Economic incentives for additional critical experimentation applicable to fuel dissolution
[DE82-006818] p 106 N83-17737

Swedish national and local government programs for conservation of energy in buildings

[PB82-246752] p 22 N83-19307
National implications of high solar and biomass energy growth A technology assessment of solar energy systems The TASE Project
[DE83-004935] p 34 N83-21638

INCIDENCE

The design, effectiveness and construction of passive-thermal-control roofing shingles
[DE83-001465] p 75 N83-21557

INCINERATORS

Simulation of air-pollution propagation resulting from at-sea incineration wastes
[DE82-902297] p 10 N83-16979
Energy recovery and cogeneration from an existing municipal incinerator Phase 2A Final design
[DE82-007911] p 179 N83-21577

INDEXES (DOCUMENTATION)

Energy data base guide to abstracting and indexing
[DE82-005748] p 200 N83-20821

INDIA

Structural geomorphology of Rajasthan basin, India-interpreted through Landsat imagery and aerial photos p 92 A83-24626

INDICATING INSTRUMENTS

Slideslip indication system p 12 N83-17466

INDIUM PHOSPHIDES

Effect of grain boundaries on the minority carrier diffusion length in InP solar cells p 40 A83-22908

INDOOR AIR POLLUTION

Radon-daughter exposures in energy-efficient buildings
[DE82-003711] p 9 N83-16964

INDUCTION MOTORS

Power factor controllers p 80 N83-22510

INDUSTRIAL ENERGY

Current aspects of wind-energy utilization - Status and prospects in Bulgaria --- wind resources and site selection for industrial applications p 91 A83-22421
Can industry afford solar energy p 44 A83-25144
Direct-contact air/molten salt heat exchange for solar thermal systems p 47 A83-27234
Development of solar total energy system for industrial sectors p 48 A83-27244
Steam ejector as an industrial heat pump
[DE82-010194] p 14 N83-17847
Opportunities for direct-contact waste heat recuperators for industrial heat recovery
[DE82-006280] p 15 N83-18038
Geothermal energy: Opportunities for California commerce, phase 1 report
[DE82-009121] p 110 N83-18066
Federal energy conservation programs Perspectives from the public and private sectors Volume 2 Public hearing, July 14 and 15, 1981, Washington, D C
[PB82-238544] p 22 N83-19313
Introduction to the nonresidential buildings energy-consumption survey 1979-1980 building characteristics, energy end use and fuel oil tank data Public use data tapes, shoppers' guide
[DE82-012522] p 27 N83-20424
Energy efficient industrial technology in Europe A compendium
[PB83-102327] p 28 N83-20442
Energy inputs and outputs of fuel-alcohol production, summary volume
[DE83-000367] p 129 N83-21174
Energy inputs and outputs of fuel-alcohol production Appendices A and B, ethanol from grain
[DE83-000368] p 129 N83-21175
Intermediate photovoltaic system application experiment operational performance report Volume 5 For CDC Light Manufacturing Building, San Bernardino, California, for July 1982
[DE83-003801] p 73 N83-21517
Photovoltaic off-farm agricultural applications Volume 2 Technical report
[DE82-009320] p 76 N83-21562
Computer-aided industrial process design The ASPEN project
[DE82-014469] p 181 N83-22484
Possibilities of improving degree of perfection and effectiveness of use of secondary thermal energy resources
[BLL-M-26859-(5825 4)] p 143 N83-22738

Swedish national and local government programs for conservation of energy in buildings
[PB82-246752] p 22 N83-19307
National implications of high solar and biomass energy growth A technology assessment of solar energy systems The TASE Project
[DE83-004935] p 34 N83-21638

The design, effectiveness and construction of passive-thermal-control roofing shingles
[DE83-001465] p 75 N83-21557
Simulation of air-pollution propagation resulting from at-sea incineration wastes
[DE82-902297] p 10 N83-16979
Energy recovery and cogeneration from an existing municipal incinerator Phase 2A Final design
[DE82-007911] p 179 N83-21577

Indexes (Documentation)
Energy data base guide to abstracting and indexing
[DE82-005748] p 200 N83-20821
India
Structural geomorphology of Rajasthan basin, India-interpreted through Landsat imagery and aerial photos p 92 A83-24626
Indicating instruments
Slideslip indication system p 12 N83-17466
Indium phosphides
Effect of grain boundaries on the minority carrier diffusion length in InP solar cells p 40 A83-22908
Indoor air pollution
Radon-daughter exposures in energy-efficient buildings
[DE82-003711] p 9 N83-16964
Induction motors
Power factor controllers p 80 N83-22510
Industrial energy
Current aspects of wind-energy utilization - Status and prospects in Bulgaria --- wind resources and site selection for industrial applications p 91 A83-22421
Can industry afford solar energy p 44 A83-25144
Direct-contact air/molten salt heat exchange for solar thermal systems p 47 A83-27234
Development of solar total energy system for industrial sectors p 48 A83-27244
Steam ejector as an industrial heat pump
[DE82-010194] p 14 N83-17847
Opportunities for direct-contact waste heat recuperators for industrial heat recovery
[DE82-006280] p 15 N83-18038
Geothermal energy: Opportunities for California commerce, phase 1 report
[DE82-009121] p 110 N83-18066
Federal energy conservation programs Perspectives from the public and private sectors Volume 2 Public hearing, July 14 and 15, 1981, Washington, D C
[PB82-238544] p 22 N83-19313
Introduction to the nonresidential buildings energy-consumption survey 1979-1980 building characteristics, energy end use and fuel oil tank data Public use data tapes, shoppers' guide
[DE82-012522] p 27 N83-20424
Energy efficient industrial technology in Europe A compendium
[PB83-102327] p 28 N83-20442
Energy inputs and outputs of fuel-alcohol production, summary volume
[DE83-000367] p 129 N83-21174
Energy inputs and outputs of fuel-alcohol production Appendices A and B, ethanol from grain
[DE83-000368] p 129 N83-21175
Intermediate photovoltaic system application experiment operational performance report Volume 5 For CDC Light Manufacturing Building, San Bernardino, California, for July 1982
[DE83-003801] p 73 N83-21517
Photovoltaic off-farm agricultural applications Volume 2 Technical report
[DE82-009320] p 76 N83-21562
Computer-aided industrial process design The ASPEN project
[DE82-014469] p 181 N83-22484
Possibilities of improving degree of perfection and effectiveness of use of secondary thermal energy resources
[BLL-M-26859-(5825 4)] p 143 N83-22738

Swedish national and local government programs for conservation of energy in buildings
[PB82-246752] p 22 N83-19307
National implications of high solar and biomass energy growth A technology assessment of solar energy systems The TASE Project
[DE83-004935] p 34 N83-21638

The design, effectiveness and construction of passive-thermal-control roofing shingles
[DE83-001465] p 75 N83-21557
Simulation of air-pollution propagation resulting from at-sea incineration wastes
[DE82-902297] p 10 N83-16979
Energy recovery and cogeneration from an existing municipal incinerator Phase 2A Final design
[DE82-007911] p 179 N83-21577

Indexes (Documentation)
Energy data base guide to abstracting and indexing
[DE82-005748] p 200 N83-20821
India
Structural geomorphology of Rajasthan basin, India-interpreted through Landsat imagery and aerial photos p 92 A83-24626
Indicating instruments
Slideslip indication system p 12 N83-17466
Indium phosphides
Effect of grain boundaries on the minority carrier diffusion length in InP solar cells p 40 A83-22908
Indoor air pollution
Radon-daughter exposures in energy-efficient buildings
[DE82-003711] p 9 N83-16964
Induction motors
Power factor controllers p 80 N83-22510
Industrial energy
Current aspects of wind-energy utilization - Status and prospects in Bulgaria --- wind resources and site selection for industrial applications p 91 A83-22421
Can industry afford solar energy p 44 A83-25144
Direct-contact air/molten salt heat exchange for solar thermal systems p 47 A83-27234
Development of solar total energy system for industrial sectors p 48 A83-27244
Steam ejector as an industrial heat pump
[DE82-010194] p 14 N83-17847
Opportunities for direct-contact waste heat recuperators for industrial heat recovery
[DE82-006280] p 15 N83-18038
Geothermal energy: Opportunities for California commerce, phase 1 report
[DE82-009121] p 110 N83-18066
Federal energy conservation programs Perspectives from the public and private sectors Volume 2 Public hearing, July 14 and 15, 1981, Washington, D C
[PB82-238544] p 22 N83-19313
Introduction to the nonresidential buildings energy-consumption survey 1979-1980 building characteristics, energy end use and fuel oil tank data Public use data tapes, shoppers' guide
[DE82-012522] p 27 N83-20424
Energy efficient industrial technology in Europe A compendium
[PB83-102327] p 28 N83-20442
Energy inputs and outputs of fuel-alcohol production, summary volume
[DE83-000367] p 129 N83-21174
Energy inputs and outputs of fuel-alcohol production Appendices A and B, ethanol from grain
[DE83-000368] p 129 N83-21175
Intermediate photovoltaic system application experiment operational performance report Volume 5 For CDC Light Manufacturing Building, San Bernardino, California, for July 1982
[DE83-003801] p 73 N83-21517
Photovoltaic off-farm agricultural applications Volume 2 Technical report
[DE82-009320] p 76 N83-21562
Computer-aided industrial process design The ASPEN project
[DE82-014469] p 181 N83-22484
Possibilities of improving degree of perfection and effectiveness of use of secondary thermal energy resources
[BLL-M-26859-(5825 4)] p 143 N83-22738

Swedish national and local government programs for conservation of energy in buildings
[PB82-246752] p 22 N83-19307
National implications of high solar and biomass energy growth A technology assessment of solar energy systems The TASE Project
[DE83-004935] p 34 N83-21638

The design, effectiveness and construction of passive-thermal-control roofing shingles
[DE83-001465] p 75 N83-21557
Simulation of air-pollution propagation resulting from at-sea incineration wastes
[DE82-902297] p 10 N83-16979
Energy recovery and cogeneration from an existing municipal incinerator Phase 2A Final design
[DE82-007911] p 179 N83-21577

Indexes (Documentation)
Energy data base guide to abstracting and indexing
[DE82-005748] p 200 N83-20821
India
Structural geomorphology of Rajasthan basin, India-interpreted through Landsat imagery and aerial photos p 92 A83-24626
Indicating instruments
Slideslip indication system p 12 N83-17466
Indium phosphides
Effect of grain boundaries on the minority carrier diffusion length in InP solar cells p 40 A83-22908
Indoor air pollution
Radon-daughter exposures in energy-efficient buildings
[DE82-003711] p 9 N83-16964
Induction motors
Power factor controllers p 80 N83-22510
Industrial energy
Current aspects of wind-energy utilization - Status and prospects in Bulgaria --- wind resources and site selection for industrial applications p 91 A83-22421
Can industry afford solar energy p 44 A83-25144
Direct-contact air/molten salt heat exchange for solar thermal systems p 47 A83-27234
Development of solar total energy system for industrial sectors p 48 A83-27244
Steam ejector as an industrial heat pump
[DE82-010194] p 14 N83-17847
Opportunities for direct-contact waste heat recuperators for industrial heat recovery
[DE82-006280] p 15 N83-18038
Geothermal energy: Opportunities for California commerce, phase 1 report
[DE82-009121] p 110 N83-18066
Federal energy conservation programs Perspectives from the public and private sectors Volume 2 Public hearing, July 14 and 15, 1981, Washington, D C
[PB82-238544] p 22 N83-19313
Introduction to the nonresidential buildings energy-consumption survey 1979-1980 building characteristics, energy end use and fuel oil tank data Public use data tapes, shoppers' guide
[DE82-012522] p 27 N83-20424
Energy efficient industrial technology in Europe A compendium
[PB83-102327] p 28 N83-20442
Energy inputs and outputs of fuel-alcohol production, summary volume
[DE83-000367] p 129 N83-21174
Energy inputs and outputs of fuel-alcohol production Appendices A and B, ethanol from grain
[DE83-000368] p 129 N83-21175
Intermediate photovoltaic system application experiment operational performance report Volume 5 For CDC Light Manufacturing Building, San Bernardino, California, for July 1982
[DE83-003801] p 73 N83-21517
Photovoltaic off-farm agricultural applications Volume 2 Technical report
[DE82-009320] p 76 N83-21562
Computer-aided industrial process design The ASPEN project
[DE82-014469] p 181 N83-22484
Possibilities of improving degree of perfection and effectiveness of use of secondary thermal energy resources
[BLL-M-26859-(5825 4)] p 143 N83-22738

Enlargement of the raw material basis of refineries by including hard coal Pilot plant for coal hydrogenation, construction phase
[BMFT-FB-1-82-192] p 126 N83-21054

SRC-I project Baseline
[DE83-000987] p 127 N83-21086
Ethanol production in small- to medium-size facilities
[DE83-900875] p 146 N83-22807

INDUSTRIAL SAFETY

Publications in life sciences synthetic fuels of Oak Ridge National Laboratory
[DE83-001701] p 122 N83-19945

INDUSTRIAL WASTES

Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 2 [BMFT-FB-T-82-151-VOL-2] p 15 N83-18027

INDUSTRIES

West Europe report Science and technology, no 134 [JPRS-82666] p 199 N83-17761

The iron and steel industry Energy consumption and conservation in the iron and steel industry
[ENERGY-AUDIT-SER-16] p 14 N83-18020

Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 1 [BMFT-FB-T-82-151-VOL-1] p 15 N83-18026

Study of domestic social and economic impacts of Ocean Thermal Energy Conversion (OTEC) commercial development Volume 2 Industry profiles
[DE83-001112] p 21 N83-19292

Economic feasibility of solar thermal industrial applications and selected case studies
[DE82-009503] p 66 N83-19303

INERTIAL CONFINEMENT FUSION

Laser-plasma interaction experiments at laser wavelengths of 1 064 micron, 0 532 micron and 0 355 micron
[DE82-013992] p 175 N83-20114

INFORMATION

A data-gathering method for use in modeling energy research, development and demonstration programs
[DE82-006153] p 16 N83-18040

INFORMATION DISSEMINATION

Energygrams Brief descriptions of energy technology
[DE82-003278] p 199 N83-16891

Energygrams Brief descriptions of energy technology
[DE82-003277] p 199 N83-16892

Environmetrics of synfuels Part 4 Project Results Tracking System (PRTS)
[DE82-011444] p 10 N83-16977

Computerized engine and airplane performance monitoring programs p 12 N83-17465
Activities report in space research in the Federal Republic of Germany p 200 N83-19702

The Alternative Fuels for Medium Speed Diesel Engines (AFFMSDE) project A baseline program planning concept for review and revision
[DE83-002565] p 141 N83-22461

Energygrams Brief descriptions of energy technology
[DE83-001868] p 35 N83-22792

INFORMATION RETRIEVAL

Activities report in space research in the Federal Republic of Germany p 200 N83-19702
Bartlesville Energy Technology Center enhanced oil recovery project data base
[DE82-012568] p 123 N83-20333

INFORMATION SYSTEMS

Energy data base guide to abstracting and indexing
[DE82-005748] p 200 N83-20821

INFRARED ABSORPTION

Propagation at 10 microns through smoke produced by atmospheric combustion of diesel fuel p 3 A83-26641

INFRARED DETECTORS

Development of a quiet Stirling cycle multi-fuel engine for electric power generation
[AD-A121033] p 174 N83-19278

INFRARED RADIATION

Development of a continuous methane monitor
[PB82-244245] p 114 N83-19078
Photovoltaic 1-5 curve measurement techniques
[DE83-000447] p 80 N83-22534

INFRARED REFLECTION

Chemically vapor-deposited black molybdenum films of high IR reflectance and significant solar absorptance
p 44 A83-25534

INJECTION

Boundary-layer control by means of strong injection
[DE82-012547] p 142 N83-22568

INSOLATION

On insulation measurements using pyranometers and solar cell devices p 48 A83-27238
A probability density function for the clearness index, with applications p 53 A83-28938

INSTALLING

- Annual thermal performance of sunspace-type passive-solar collectors for residence heating Attached and semi-enclosed geometries
[DE83-002310] p 56 N83-16888
- Terrestrial solar spectral data sets
[DE83-000504] p 60 N83-17001
- Environmental data for sites in the National Solar Data Network
[DE82-007055] p 64 N83-19280
- Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field
[DFVLR-FB-82-27] p 73 N83-21515
- ### INSTALLING
- Automated installation methods for photovoltaic arrays
[DE83-004272] p 82 N83-22796
- ### INSULATION
- Investigation of attic insulation effectiveness using actual energy consumption data
[DE83-000225] p 36 N83-22828
- ### INTAKE SYSTEMS
- Repetitive switching for inductive energy storage
[AD-A121029] p 194 N83-19277
- ### INTERFACES
- Fourth ESTEC spacecraft power-conditioning seminar
[ESA-SP-186] p 176 N83-21006
- ### INTERFERENCE
- Initial utility experience with cluster of three Mod-2 wind turbine systems
p 173 N83-19268
- ### INTERNAL COMBUSTION ENGINES
- Rotary engines
p 152 A83-25140
- The assessment of variable valve timing of internal combustion engines for fuel economy improvements and practicability
[PB82-265364] p 5 N83-16766
- Rationale for advances in the technology of I C engines
[DE82-000264] p 14 N83-17886
- A rationale for advances in the technology of I C engines
[DE82-005840] p 14 N83-17889
- A clean internal combustion engine for underground mining machinery A technical assessment and program plan, phase 1
[PB82-244724] p 89 N83-19104
- Combustion engine system
[NASA-CASE-NPO-14565-2] p 89 N83-19826
- Review and evaluation of automotive fuel technologies Volume 1 Summary
[PB83-101147] p 30 N83-20845
- A study of possible detrimental effects on internal combustion engines by the combustion of gasohol blends
[CSIR-ME-446] p 129 N83-21166
- Fleet experience using a methanol/unleaded gasoline blend
[DE83-003834] p 129 N83-21171
- Reformed methanol
[DE83-002096] p 129 N83-21176
- Roadway-powered electric-vehicle impact study analysis of selected utility-service areas
[DE83-003143] p 180 N83-22030
- The Alternative Fuels for Medium Speed Diesel Engines (AFFMSDE) project A baseline program planning concept for review and revision
[DE83-002565] p 141 N83-22461
- Ignition technique for conventional motors by high energy spark
[INPE-2645-TDL/116] p 142 N83-22594
- Study of vacuum systems for a heat engine/flywheel automotive propulsion system
[DE83-002284] p 198 N83-23244
- ### INTERNATIONAL COOPERATION
- World oil model development
[DE82-013979] p 25 N83-20334
- ### INTERNATIONAL TRADE
- US solar and conservation technologies in international markets
[GPO-99-627] p 25 N83-20369
- ### INTERPOLATION
- Interpolation and transformations of maps --- French theses
p 94 A83-28632
- ### INTERRUPTION
- High-cycle-life, high-energy-density nickel-zinc batteries
[DE82-012896] p 195 N83-20376
- ### INTRUSION
- A study of the United States coal resources
[NASA-CR-169792] p 101 N83-16993
- ### INVENTIONS
- Federal Technology Catalog 1982 Summaries of practical technology
[PB83-121533] p 200 N83-22480
- ### INVESTIGATION
- Solar energy systems Standards for screening plastic containment materials
[PB82-242454] p 62 N83-18921

SUBJECT INDEX

- ### IODINE COMPOUNDS
- Status report on sulfur iodine thermochemical water-splitting cycle
[DE82-007164] p 88 N83-17633
- ### ION BEAMS
- Applications of ion beam technology
[NASA-CR-169797] p 88 N83-16493
- ### ION EXCHANGING
- Critique of conceptual design for removal of sodium from lignite by ion exchange
[DE82-010789] p 95 N83-16439
- Liquefaction behavior of a Canadian subbituminous coal in companson with several US lignites and subbituminous coals
[DE82-021976] p 146 N83-22824
- ### ION IMPLANTATION
- Application of laser annealing and laser-induced diffusion to photovoltaic conversion
[DE82-006792] p 61 N83-18056
- ### IONIC REACTIONS
- The uranyl ion, fluorescent and fluonne-like - A review
p 45 A83-26061
- ### IONIZATION
- The plasmadynamics and ionization kinetics of thermionic energy conversion
[DE82-012938] p 176 N83-20421
- ### IRON
- The iron and steel industry Energy consumption and conservation in the iron and steel industry
[ENERGY-AUDIT-SER-16] p 14 N83-18020
- ### IRON CHLORIDES
- Study to establish cost predictions for the production of Redox chemicals
[NASA-CR-167882] p 194 N83-20359
- ### IRON ORES
- Replacement of lumpy chrome ore by agglomerated ore concentrates and lowering of specific power consumption and improvement of Cr yield by means of improved slag composition in the production of HC ferrochrome
[BMFT-FB-T-82-084] p 7 N83-16929
- ### IRON OXIDES
- Hot-gas cleanup for molten-carbonate fuel cells
[DE82-002500] p 163 N83-16864
- ### IRRADIANCE
- Mesoscale mapping of available hourly solar irradiance by use of data collected by 'Meteosat'
p 43 A83-24633
- A probability density function for the clearness index, with applications
p 53 A83-28938
- ### IRRADIATION
- Long term solar irradiation heating of black chrome
[DE83-000032] p 58 N83-16909
- ### IRRIGATION
- Irrigation pumping using geothermal energy
[DE83-005308] p 135 N83-21641
- ### ISLANDS
- Geothermal potential of Ascension Island, south Atlantic Phase 1 Preliminary examination
[DE83-004066] p 132 N83-21523
- ### ISOMERIZATION
- Photochemical storage potential of azobenzenes
p 191 A83-28941
- ### J
- ### JET AIRCRAFT
- The MCA method, a flight test technique to determine the thrust of jet aircraft in flight --- Mass Consumption Acceleration
p 1 A83-19661
- Fuel/engine/airframe trade-off study Operational effects of increased freeze point fuels
[AD-A121688] p 129 N83-21169
- ### JET ENGINE FUELS
- Fuel for future transport aircraft
p 85 A83-20082
- Anti-misting additives for jet fuels
[NASA-CR-169751] p 94 N83-16417
- Viscometric and misting properties of polymer-modified fuel
[NASA-CR-169750] p 96 N83-16543
- Potential fuel savings through improved airframe maintenance
p 11 N83-17456
- Fuel/engine/airframe trade-off study Operational effects of increased freeze point fuels
[AD-A121688] p 129 N83-21169
- ### JET FLOW
- Prediction of turbulent mixing in confined co-axial reacting jets
p 91 A83-23191
- ### JET IMPINGEMENT
- Flames with impinging jets
p 91 A83-21423
- Improved Stirling engine performance using jet impingement
p 158 A83-27288
- ### JETTISONING
- Ground contamination by fuel jettisoned from aircraft in flight
p 1 A83-24041

- ### JOINING
- Stochastic methods for analysis of power flow in electric networks
[DE83-000445] p 5 N83-16653
- Evaluation of various solar-cell-to-interconnector welds by means of scanning laser acoustic microscopy and metallography
[ESA-STM-225] p 73 N83-21514
- Development of technologies for welding interconnects to fifty-micron thick silicon solar cells
[NASA-CR-170212] p 81 N83-22742
- ### JOINTS (JUNCTIONS)
- Analysis of thermal and mechanical stresses in the ceramic seal of the 1-MW(th) bench model solar receiver
[DE82-901870] p 67 N83-20298
- ### JP-4 JET FUEL
- Environmental quality research Fate of toxic jet fuel components in aquatic systems
[AD-A122548] p 30 N83-21168

K

- ### KANSAS
- Heat flow and geothermal potential of Kansas
[DE83-003235] p 134 N83-21609
- Assessment of the geothermal resources of Kansas Volume 2 Appendices, section 3
[DE83-003222] p 143 N83-22697
- Assessment of the geothermal resources of Kansas Volume 2 Appendices, section 4
[DE83-003215] p 143 N83-22698
- Assessment of the geothermal resources of Kansas
[DE83-003234] p 145 N83-22790
- ### KEROSENE
- Investigation of slurry fuel performance for use in a ramjet propulsor
p 90 A83-21014
- Degradation and characterization of antimisting kerosene
p 92 A83-24035
- Shock initiated ignition in heptane-oxygen-argon mixtures
p 93 A83-26198
- The properties of fuel fractions obtained by the hydrogenation of Kansk-Achinsk coal
p 94 A83-26920
- Degradation and characterization of antimisting kerosene (AMK)
[MED-132] p 120 N83-19922
- ### KINETIC ENERGY
- Hail impact testing procedure for solar collector covers
[PB83-104745] p 84 N83-22841
- ### KINETICS
- The plasmadynamics and ionization kinetics of thermionic energy conversion
[DE82-012938] p 176 N83-20421

L

- ### LABORATORY EQUIPMENT
- Design and experiences with a laboratory Stirling cycle machine
p 157 A83-27284
- ### LAKES
- Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197
- ### LAMINAR FLOW
- Laminar burning velocities of hydrogen-air and hydrogen-air-steam flames
p 85 A83-19837
- Velocity measurements in an axisymmetric laminar flow using an optical technique of visualization in coherent light
p 54 A83-29704
- ### LAMINATES
- Industrial technology for economic and viable encapsulation for large solar panels
[PB82-259839] p 59 N83-16936
- Review and evaluation of automotive fuel technologies Volume 1 Summary
[PB83-101147] p 30 N83-20845
- ### LAND USE
- Use of remote sensing techniques to study geothermal resources in arid and semi-arid zones in Chile
p 92 A83-24577
- Survey of lands held for uranium exploration, development and production in fourteen western states for the six-month period ending June 30, 1981
[DE82-006228] p 99 N83-16838
- Energy development on Native American lands Resources and attitudes An interpretive report on two major Indian conferences of 1980
[DE82-009539] p 17 N83-18076
- The Illinois State Geological Survey The next quarter century
p 112 N83-18139
- Putting wind resource atlases to use
p 115 N83-19237

SUBJECT INDEX

- Alaskan coal Resources and developmental constraints [DE83-000860] p 130 N83-21494
- Energy from biomass Land analysis and evaluation of supply models [DE83-003333] p 132 N83-21524
- LANDFILLS**
- Landfill gas to electricity demonstration project [PB82-255290] p 7 N83-16943
- Methane from landfills Preliminary assessment workbook [DE83-002319] p 111 N83-18075
- Development of the utilization of combustible gas produced in existing sanitary landfills: Effects of corrosion at the Mountain View, California landfill gas-recovery plant [DE83-001576] p 145 N83-22769
- LANDSAT SATELLITES**
- Tectonic elements registered on the Landsat imagery in area of Yugoslavia and their practical meaning p 91 A83-21945
- LARGE SPACE STRUCTURES**
- Orbital ring systems and Jacob's Ladders III p 185 A83-29457
- LASER ANNEALING**
- Application of laser annealing and laser-induced diffusion to photovoltaic conversion [DE82-006792] p 61 N83-18056
- LASER DOPPLER VELOCIMETERS**
- Laminar burning velocities of hydrogen-air and hydrogen-air-steam flames p 85 A83-19837
- LASER FUSION**
- Coatings for laser fusion [DE82-005698] p 165 N83-17330
- LASER PLASMA INTERACTIONS**
- Laser-plasma interaction experiments at laser wavelengths of 1.064 micron, 0.532 micron and 0.355 micron [DE82-013992] p 175 N83-20114
- LASER PUMPING**
- Theoretical studies of solar-pumped lasers [NASA-CR-169890] p 60 N83-17871
- LASER SPECTROSCOPY**
- Laser fluorescence measurements of the OH concentration in a combustion boundary layer p 86 A83-24367
- Propagation at 10 microns through smoke produced by atmospheric combustion of diesel fuel p 3 A83-26641
- LASER WELDING**
- Lightweight solar array blanket tooling, laser welding and cover process technology [NASA-CR-170209] p 81 N83-22741
- LATITUDE MEASUREMENT**
- PLTSYM A FORTRAN computer system to plot Canadian symbol location maps for hydrogeochemical and stream-sediment reconnaissance data [DE83-000764] p 123 N83-20337
- LAW (JURISPRUDENCE)**
- Program management plan for the conduct of a research, development and demonstration program for improving the safety of nuclear powerplants [DE82-008776] p 19 N83-18555
- LEACHING**
- Leachate-treatment technique utilizing fly ash as low-cost sorbent [DE82-010501] p 111 N83-18101
- LEAD (METAL)**
- Rates and equilibria of devolatilization and trace element evolution in coal pyrolysis [PB82-260944] p 96 N83-16460
- Trends in motor gasolines, 1942 - 1981 [DE82-021124] p 96 N83-16550
- LEAD ACID BATTERIES**
- Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment [NASA-CR-169801] p 191 N83-16858
- Bipolar lead accumulator cell with high energy density [PB82-258757] p 193 N83-16934
- Generic environmental and safety assessment of 5 battery energy-storage systems p 23 N83-19334
- Study of battery accelerated-testing techniques [DE82-017125] p 198 N83-22834
- LENS DESIGN**
- Design and development of monolithic acrylic Fresnel lenses for use in point-focus PV systems [DE82-007554] p 72 N83-20768
- LIFE (DURABILITY)**
- Catalyst durability evaluation for advanced gas turbine engines [ASME PAPER 82-JPGC-GT-21] p 152 A83-25270
- Studies of the mechanisms of turbine fuel instability [NASA-CR-167963] p 114 N83-18924

LIFE CYCLE COSTS

- User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 1 Main text [DE82-022512] p 99 N83-16865
- Study of installed and life-cycle costs for batteries in photovoltaic power systems [DE83-003849] p 74 N83-21522

LIFE SCIENCES

- Federal Technology Catalog 1982 Summaries of practical technology [PB83-121533] p 200 N83-22480

LIGHT (VISIBLE RADIATION)

- Efficient daylighting in thermally controlled environments [DE82-003045] p 6 N83-16885

LIGHT SCATTERING

- Simplified calculational procedure for determining the amount of intercepted sunlight in an imaging solar concentrator p 43 A83-23884

LIGHT TRANSMISSION

- Light transport in planar luminescent solar concentrators - The role of DCM self-absorption --- 4-dicyano-methylene-2-methyl-6-p-dimethyl H-pyran p 39 A83-22619
- Annual thermal performance of sunspace-type passive-solar collectors for residence heating Attached and semi-enclosed geometries [DE83-002310] p 56 N83-16888
- Solar-collector materials exposure to the IPH site environment Task 5.0 [DE83-002192] p 62 N83-18072

LIGNITE

- Critique of conceptual design for removal of sodium from lignite by ion exchange [DE82-010789] p 95 N83-16439
- Effects of several disposable catalysts on liquefaction of lignite [DE82-022188] p 138 N83-22351
- Liquefaction behavior of a Canadian subbituminous coal in comparison with several US lignites and subbituminous coals [DE82-021976] p 146 N83-22824

LINE SPECTRA

- Thermal-receiver designs for line-focus solar collectors [DE82-012067] p 82 N83-22777

LINEAR SYSTEMS

- ARLIS 1.0 Linear investigation of aeroelastic systems in rotation [ISD-293] p 166 N83-17905

LINEARITY

- Wave model A numerical model for the frictional absorption of water waves [PB83-100792] p 122 N83-20073

LIQUEFACTION

- The effect of parasitic refrigeration on the efficiency of magnetic liquefiers p 155 A83-27212
- Bench scale research in biomass direct liquefaction [DE82-005228] p 100 N83-16905
- Fossil energy program [DE82-007496] p 111 N83-18082
- Direct liquefaction of biomass Results from operation of continuous bench scale unit in liquefaction of water slurries of Douglas fir wood [DE82-015703] p 124 N83-20414

LIQUEFIED NATURAL GAS

- Ignition sources of LNG vapor clouds [PB82-262577] p 96 N83-16461
- Recent flame-propagation experiments at LLNL within the liquefied gaseous-fuels spill-safety program [DE82-010729] p 103 N83-17651
- FDAS hardware and firmware description, Liquefied Gaseous Fuels (LGF) data-acquisition system [DE82-012602] p 107 N83-17741
- West Europe report Science and technology, no 133 [JPRS-82608] p 89 N83-17757
- LPG, hydrogen Automobile fuels of tomorrow discussed p 89 N83-17758
- Heavy Gas Dispersal [VKI-LS-1982-03] p 200 N83-19316
- Introductory lecture Statement of the problem p 200 N83-19317
- Identification of problem areas related to the dispersion of heavy gases p 200 N83-19318

LIQUID CHROMATOGRAPHY

- Chemical effects in vaporizing synthetic fuels [DE82-003352] p 96 N83-16549
- High performance liquid chromatographic hydrocarbon group-type analyses of mid-distillates employing fuel-derived fractions as standards [NASA-TM-83072] p 120 N83-19920

LIQUID COOLING

- Increasing summer peak power with aquifer storage p 191 A83-27313

LOGISTICS MANAGEMENT

- Materials research for hydrogen-cooled Superconducting Power-Transmission Lines (SPTL) Part 1 Liquid hydrogen as a dielectric Part 2 Superconducting materials [DE83-004801] p 187 N83-22529

LIQUID FLOW

- The generation of electric currents by the turbulent flow of dielectric liquids I - Long pipes p 161 A83-29089

LIQUID FUELS

- Fuel for future transport aircraft p 85 A83-20082
- Spray combustion processes - A review [ASME PAPER 82-WA/HT-86] p 93 A83-25691
- Liquid fossil-fuel technology [DE83-002501] p 121 N83-19937
- Fuel quality-processing study Volume 1 Overview and results [NASA-CR-165326-VOL-1] p 143 N83-22750
- Fuel quality-processing study Volume 2 Literature survey [NASA-CR-165326-VOL-2] p 143 N83-22751
- Perspective on our energy options [DE82-005828] p 36 N83-22802

LIQUID HYDROGEN

- Fuel for future transport aircraft p 85 A83-20082
- Is LH2 the high cost option for aircraft fuel p 87 A83-27215

- A preliminary study of environmental parameters associated with the feasibility of a polygeneration plant at Kennedy Space Center p 11 N83-17385

- Materials research for hydrogen-cooled Superconducting Power-Transmission Lines (SPTL) Part 1 Liquid hydrogen as a dielectric Part 2 Superconducting materials [DE83-004801] p 187 N83-22529

LIQUID INJECTION

- Oil and gas p 34 N83-22674

LIQUID PHASES

- Mass transfer and chemical reaction of gaseous species in non-catalytic and catalytic porous media supporting catalytic and non-catalytic liquids [DE82-021713] p 95 N83-16427
- Theoretical studies of solar-pumped lasers [NASA-CR-169890] p 60 N83-17871
- Liquid-phase methanol process development unit Installation, operation, and support studies [DE82-012725] p 121 N83-19940

LITHIUM

- Stored chemical energy propulsion system for underwater applications [AJAA PAPER 81-1601] p 188 A83-23132

LITHIUM COMPOUNDS

- The effect of the melt heat treatment time on the properties of lithium lubricants with additives p 94 A83-26921

LITHIUM SULFUR BATTERIES

- Comparison of Na/S and LiAl/FeS batteries p 188 A83-27189
- Abuse resistant high rate lithium/thionyl chloride cells p 154 A83-27180

LITHOLOGY

- Lithology and hydrothermal alteration determination from well logs for the Cerro Prieto Wells, Mexico [DE82-004677] p 101 N83-17000
- Colado geothermal resource assessment Shallow-hole temperature survey Intermediate-depth holes IGH no 1 and no 2, Depth test hole 44X-10 [DE83-002898] p 135 N83-21621

LOAD TESTS

- Study on composite flywheels for energy storage p 188 A83-22701

LOADING MOMENTS

- Stochastic methods for analysis of power flow in electric networks [DE83-000445] p 5 N83-16653
- Oxygen supply for coal gasification power stations (combined cycle process) [BMFT-FB-T-82-018] p 131 N83-21505

LOADS (FORCES)

- Solar/gas Rankine/Rankine-cycle heat pump assessment [PB82-254863] p 55 N83-16710
- Force imitations in helicopter rotor blades, wind channel fans and wind turbines [MBS-UD-356-82-0] p 166 N83-17522

LOCOMOTIVES

- A systems analysis comparing conventional and hydrogen powered rail locomotives p 87 A83-27213
- Feasibility evaluation of fuel cells for selected heavy-duty transportation systems [DE83-002953] p 179 N83-21550

LOGISTICS MANAGEMENT

- An Energy Crisis Management Simulation for the State of California [RAND/R-2899-CEC] p 25 N83-20383

LONG TERM EFFECTS

A study of possible detrimental effects on internal combustion engines by the combustion of gasohol blends
[CSIR-ME-446] p 129 N83-21166

LONGITUDE MEASUREMENT

PLTSYM A FORTRAN computer system to plot Canadian symbol location maps for hydrogeochemical and stream-sediment reconnaissance data
[DE83-000764] p 123 N83-20337

LOSSES

Power factor controllers p 80 N83-22510

LOUISIANA

A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas
[DE83-004095] p 135 N83-21686

LOW CONCENTRATIONS

Low concentration rater solar array for low Earth orbit multi-100 kW application
[NASA-CR-170729] p 67 N83-20360

LOW COST

Process research of non-cz silicon material Low cost solar array project, cell and module formation research area
[NASA-CR-169899] p 63 N83-19221
Low-cost, high-performance solar flat-plate collectors for applications in northern latitudes
[DE82-010626] p 71 N83-20428

LOW TEMPERATURE

Fuel/engine/airframe trade-off study Operational effects of increased freeze point fuels
[AD-A121688] p 129 N83-21169

LUBRICATING OILS

The effect of the melt heat treatment time on the properties of lithium lubricants with additives p 94 A83-26921
Association-solvation characteristic of fuels and lubricating and hydraulic oils
[NASA-TM-76957] p 96 N83-16525
Effect of low-proof alcohol fumigation-fueling on crankcase oil dilution in a diesel-cycle engine
[DE83-002976] p 122 N83-20171
Waste lubricating oil An annotated review, 1982 revision
[DE83-001439] p 30 N83-21156

M

MACHINE TOOLS

Design of highwall mining equipment electronic guidance package
[DE82-006115] p 108 N83-18005

MAGNESIUM

Magnesium for hydrogen storage p 88 A83-27339
Magnesia spray absorption for the removal of SO₂ from flue gas
[DE82-013443] p 28 N83-20456

MAGNESIUM COMPOUNDS

Storing energy in metal hydrides - A review of the physical metallurgy p 188 A83-21562

MAGNETIC COOLING

The effect of parasitic refrigeration on the efficiency of magnetic liquefiers p 155 A83-27212

MAGNETIC CORES

Design study of a high power rotary transformer
[NASA-CR-168012] p 186 N83-16630

MAGNETIC FIELDS

Geothermal p 143 N83-22678

MAGNETIC MIRRORS

Physics of mirror systems
[DE82-015908] p 176 N83-20770

MAGNETIC STORAGE

Superconductive energy storage
[DE83-002270] p 196 N83-21624

MAGNETIC SURVEYS

NNE-SSW fault system in part of the Gulf of Suez and its bearing on oil exploration p 92 A83-24551
Controlled source audio-magnetotelluric (CSMAT) resistivity measurements for in-situ combustion
[DE82-016398] p 120 N83-19877
Regional interpretation of Kansas aeromagnetic data
[DE83-003219] p 136 N83-21701

MAGNETIC TAPES

PLTSYM A FORTRAN computer system to plot Canadian symbol location maps for hydrogeochemical and stream-sediment reconnaissance data
[DE83-000764] p 123 N83-20337

MAGNETOHYDRODYNAMIC FLOW

MHD channel performance for potential early commercial MHD power plants p 151 A83-23134
High power pulsed plasma MHD experiments
[AD-A120526] p 176 N83-20781

MAGNETOHYDRODYNAMIC GENERATORS

Analytical investigation of axial field limitations in MHD generators p 151 A83-23126

Cross-sectional current distribution in coal fired diagonal conducting wall MHD generator p 151 A83-23130

MHD channel electrical boundary-layer theory and applications p 151 A83-23131

MHD channel performance for potential early commercial MHD power plants p 151 A83-23134

Measurement of plasma conductivity using Faraday rotation of submillimeter waves p 151 A83-23139

Discharges in the inlet region of a noble gas MHD generator --- Thesis p 161 A83-28643

Joule heating effects in MHD generator boundary layers p 161 A83-28956

Vaporization thermodynamics of K₂S and K₂SO₃
[NASA-CR-168080] p 117 N83-19812

High power pulsed plasma MHD experiments
[AD-A120526] p 176 N83-20781

High power pulsed plasma MHD experiments
[AD-A120526] p 176 N83-20782

Half-field limitations in MDH generators
[DE83-001149] p 177 N83-21246

Parametric analysis of closed cycle magnetohydrodynamic (MHD) power plants
[NASA-CR-165472] p 182 N83-22748

MAGNETOHYDRODYNAMICS

Analytical investigation of critical MHD phenomena
[NASA-CR-168079] p 169 N83-19228

Physics of mirror systems
[DE82-015908] p 176 N83-20770

High power pulsed plasma MHD experiments
[AD-A120526] p 176 N83-20782

MAGNETORESISTIVITY

Controlled source audio-magnetotelluric (CSMAT) resistivity measurements for in-situ combustion
[DE82-016398] p 120 N83-19877

MAGNETRON SPUTTERING

Reactive sputtered Ta₂O₅ antireflection coatings p 52 A83-27984

MAINTENANCE

Evaluation of the maintenance effect on fugitive emissions from refineries in the south coast air quality management district p 23 N83-19356

Meteorological field measurements at potential and actual wind-turbine sites
[DE83-001493] p 174 N83-19398

Solar-energy-system performance evaluation Honeywell OTS 44, Ocmulgee, Georgia
[NASA-CR-170031] p 74 N83-21530

Manufacture, distribution, and handling of nitrate salts for solar-thermal applications
[DE83-003317] p 79 N83-21625

DOE small-scale hydroelectric demonstration program F W E Staphenhorst, Inc., Goodyear Lake hydroelectric-generating-station redevelopment
[DE83-003156] p 182 N83-22780

Research in transportation engineering in the United States p 37 N83-23208

MANAGEMENT METHODS

An Energy Crisis Management Simulation for the State of California
[RAND/R-2899-CEC] p 25 N83-20363

MANAGEMENT PLANNING

Energy optimization in DOD facilities
[DE82-008108] p 7 N83-16925

The comprehensive community energy management program An evaluation
[DE82-011552] p 17 N83-18060

Program planning for future improvement in managing ORNL's radioactive wastes
[DE82-007721] p 19 N83-18467

Status of the Great Plains Coal Gasification Project, August 1982
[GAO/EMD-82-117] p 115 N83-19230

An overview of the Goldstone Energy Systems study p 24 N83-19780

Fuel conservation and economy constraints p 34 N83-22179

Gasoline shortfall management p 148 N83-23213

MANAGANESE
Effect of manganese additions on the performance of aluminum air-battery anode alloys
[DE83-002277] p 196 N83-21629

MANUAL
Biomass cogeneration A business assessment
[DE82-011773] p 101 N83-16928

MANUALS
A 10-MWe solar-thermal central-receiver pilot plant Solar facilities design integration Plant operating/training manual (RADL-Item 2-36)
[DE83-001670] p 75 N83-21551

MANUFACTURING
Manufacture and testing of fibre composite rotor components /Fibre composite flywheel development program for road vehicle applications/
p 190 A83-27308

A survey of manufacturers of solar thermal energy systems

[NASA-CR-169924] p 63 N83-19223

Fiberglass composite blades for the 2 MW Mod-1 wind turbine generator p 170 N83-19241

Preliminary analysis of the state of the art of robotics and precision engineering and evaluation of potential for improved energy utilization in the pulp, paper, and related energy-consuming processes

[DE83-001016] p 21 N83-19294

Utilization of secondary energy resources at Magnitogorsk Metallurgical Combine

[BLL-M-26856-(5828 4)] p 131 N83-21502

Manufacture, distribution, and handling of nitrate salts for solar-thermal applications

[DE83-003317] p 79 N83-21625

Federal Technology Catalog 1982 Summaries of practical technology

[PB83-121533] p 200 N83-22480

Silicon concentrator cell-assembly development

[DE83-001683] p 84 N83-22822

MAPPING
Oxygen isotope exchange in rocks and minerals from the Cerro Prieto geothermal system Indicators of temperature distribution and fluid flow

[DE82-001077] p 100 N83-16907

Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska

[DE82-009664] p 115 N83-19197

Controlled source audio-magnetotelluric (CSMAT) resistivity measurements for in-situ combustion

[DE82-016398] p 120 N83-19877

PLTSYM A FORTRAN computer system to plot Canadian symbol location maps for hydrogeochemical and stream-sediment reconnaissance data

[DE83-000764] p 123 N83-20337

The importance of satisfactory positioning, diving and mapping systems suitable for exploration and transportation in icecovered sea areas

[PB83-109587] p 123 N83-20342

Regional interpretation of Kansas aeromagnetic data

[DE83-003219] p 136 N83-21701

Cartographic evaluation of environmental-management strategies

[DE82-009828] p 35 N83-22702

MARINE BIOLOGY
Effects of petroleum on selected uniform substrates

A feasibility study
[PB82-255084] p 10 N83-16985

MARINE ENVIRONMENTS
The non-Federal oceanographic community An overview

[NASA-CR-169802] p 102 N83-17414

Petroleum contamination Quantification and passive tagging in organisms and sediments

[PB82-254087] p 113 N83-18880

MARINE TECHNOLOGY
Marine power - Accomplishments of the 1970s

p 155 A83-27223

Some ocean engineering considerations in the design of OTEC plants p 155 A83-27224

R and D of energy saving and new energy utilization in Japanese marine engineering p 4 A83-27225

MARINE TRANSPORTATION
Fuel-cell-propelled submarine-tanker-system study

[DE82-015149] p 183 N83-22827

MARKET RESEARCH
Systems analysis of hydrogen supplementation in natural gas pipelines

[DE82-006933] p 89 N83-17740

The promise and status of international applications of photovoltaics

[DE82-006152] p 16 N83-18042

Geothermal energy Opportunities for California commerce, phase 1 report

[DE82-008121] p 110 N83-18066

World of model development

[DE82-013979] p 25 N83-20334

MARKETING
Design and market study of photovoltaic systems for commercial building and applications Volume 3 Appendices

[DE82-016729] p 70 N83-20397

On-site fuel cell field test support program

[PB83-121723] p 28 N83-20439

Role of energy resources in New Mexico

p 34 N83-22673

MARKING
Multiple-tracer gas analyzer

[DE82-017032] p 120 N83-19876

MARYLAND
Rymark 1, Rymark 2, and Rymark 3, Frederick, Maryland Solar-energy-system performance evaluation, May 1981 through March 1982

[DE83-000067] p 57 N83-16890

MASKING

Process research of non-cz silicon material Low cost solar array project, cell and module formation research area
[NASA-CR-169899] p 63 N83-19221

MASS BALANCE

Liquid-phase methanol process development unit Installation, operation, and support studies
[DE82-012725] p 121 N83-19940

MASS DISTRIBUTION

Numerical determination of the configuration of a rotating blade with constant stress --- for vertical axis wind turbines p 150 A83-22020
Mass balance results for the Pricetown 1 underground coal gasification field test
[DE82-005667] p 162 N83-16556

MASS FLOW

The MCA method, a flight test technique to determine the thrust of jet aircraft in flight --- Mass Consumption Acceleration p 1 A83-19661
Mass flow of char/coal in oxygen-blown entrained-bed gasifiers An assessment of instruments and methods of measurement
[DE82-006988] p 107 N83-17852
Study based on ammonia/water solutions of a district heating transport system
[BMFT-FB-T-82-188] p 186 N83-18033

MASS SPECTROSCOPY

Catalytic coal conversion support Use of laser flash-pyrolysis for structural analysis
[DE82-014124] p 139 N83-22366

MASS TRANSFER

A 2D model of turbulent solar induced flows in passive air collectors p 53 A83-29039
Mass transfer and chemical reaction of gaseous species in non-catalytic and catalytic porous media supporting catalytic and non-catalytic liquids
[DE82-021713] p 95 N83-16427
Salt gradient solar pond development
[DE82-020630] p 58 N83-16916

MATERIAL ABSORPTION

Dynamic simulation of sulfur-removal systems
[DE82-902074] p 119 N83-19865

MATERIAL BALANCE

Mass balance results for the Pricetown 1 underground coal gasification field test
[DE82-005667] p 162 N83-16556

MATERIALS

Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures
[AD-A113883] p 72 N83-20802

MATERIALS HANDLING

Collection, transportation, and storage of biomass residues in the Pacific Northwest
[DE82-004737] p 100 N83-16887
High production shuttle car system for coal mines
[NASA-CASE-NPO-15949-1] p 187 N83-20155
Transportation network models for energy supply analysis Volume 1 Executive summary
[DE82-903077] p 187 N83-20399
Transportation network models for energy supply analysis Volume 3 Transportation network model user's guide and documentation
[DE82-903079] p 187 N83-20400
Safe handling and testing of alternative fuels
[DE82-009176] p 89 N83-21183
Manufacture, distribution, and handling of nitrate salts for solar-thermal applications
[DE83-003317] p 79 N83-21625

MATERIALS RECOVERY

Recovery of minerals from US coals
[DE82-008173] p 108 N83-18010
Metal recovery from eastern oil shale
[DE82-004052] p 109 N83-18016
Uranium p 143 N83-22677

MATHEMATICAL MODELS

Dynamic modeling and control analysis of froth flotation and clean-coal filtration as applied to coal beneficiation
[DE82-004555] p 97 N83-16558
Characteristics of coal/light hydrocarbon slumes in spray combustion
[DE82-006294] p 102 N83-17639
Development of standards and a cost model for coal agglomeration and related studies
[DE82-011047] p 105 N83-17678
A data-gathering method for use in modeling energy research, development and demonstration programs
[DE82-006153] p 16 N83-18040
Model simplification to examine the interrelationships between coal, gas and oil use
[DE82-007816] p 110 N83-18061
Evaluation of the mathematical and economic basis for conversion processes in the LEAP energy-economy model
[DE83-001706] p 167 N83-18079

Integrated forecasting model synthetic fuels study
Volume 1 Overview and findings
[DE82-903574] p 121 N83-19943
Wave model A numerical model for the frictional absorption of water waves
[PB83-100792] p 122 N83-20073
World oil model development
[DE82-013979] p 25 N83-20334
Transportation network models for energy supply analysis Volume 1 Executive summary
[DE82-903077] p 187 N83-20399
World oil
[DE82-906440] p 27 N83-20433
Mathematical modeling of the behavior of geothermal systems under exploitation
[DE82-010925] p 133 N83-21587

MATHEMATICAL PROGRAMMING

Mathematical programming models for the economic design and assessment of wind energy conversion systems p 161 A83-27870
Game-theory approach to consumer incentives for solar energy
[DE82-004501] p 56 N83-16882

MEASURING INSTRUMENTS

Federal Technology Catalog 1982 Summaries of practical technology
[PB83-121533] p 200 N83-22480

MECHANICAL ENGINEERING

Israel Conference on Mechanical Engineering, 16th, Technion - Israel Institute of Technology, Haifa, Israel, July 13, 14, 1982, Proceedings p 150 A83-22318
Federal Technology Catalog 1982 Summaries of practical technology
[PB83-121533] p 200 N83-22480

MECHANICAL PROPERTIES

The kinetics and mechanism of the reaction of ozone with sulphides
[BLL-OA-TRANS-1934-(6196 3)] p 94 N83-16411
Physical properties data compilations relevant to energy storage Part 5 Mechanical properties data on alloys for use in flywheels
[PB82-232919] p 194 N83-18904
Design and evaluation of low cost blades for large wind driven generating systems p 170 N83-19244
Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures
[AD-A113883] p 72 N83-20802

MEDICAL SCIENCE

Biostatistics and health impacts of energy technologies p 36 N83-22962

MELTING

Review of Thawtron device for thawing frozen coal
[DE82-903145] p 123 N83-20330
Fossil energy
[DE83-003817] p 124 N83-20383

MEMBRANES

Applications of ion beam technology
[NASA-CR-169797] p 88 N83-16493

MERCURY (METAL)

The structure of the double layer at the mercury-phosphoric acid interface from studies of adsorption of thiourea and its implications on oxygen reduction kinetics --- in fuel cells p 149 A83-19876
Rates and equilibria of devolatilization and trace element evolution in coal pyrolysis
[PB82-260944] p 96 N83-16460
Geothermal resource assessment of Idaho Springs, Colorado Resource series 16
[DE83-000345] p 110 N83-18073

MESOSCALE PHENOMENA

Mesoscale mapping of available hourly solar irradiance by use of data collected by 'Meteosat' p 43 A83-24633

METAL AIR BATTERIES

Effect of manganese additions on the performance of aluminum air-battery anode alloys
[DE83-002277] p 196 N83-21629

METAL COATINGS

Long term solar irradiation heating of black chrome
[DE83-000032] p 58 N83-16909

METAL FILMS

Long term solar irradiation heating of black chrome
[DE83-000032] p 58 N83-16909

METAL FOILS

Development of polymer film solar collectors A status report
[DE83-005995] p 80 N83-21643

METAL HYDRIDES

Storing energy in metal hydrides - A review of the physical metallurgy p 188 A83-21562
Metal hydride heat pump p 3 A83-27211
Modeling and evaluation of designs for solid hydrogen storage beds p 87 A83-27333

Theory of the computer code RET 1 for the calculation of space-time dependent temperature and composition properties of metal hydride hydrogen storage beds p 88 A83-27337

Porous metal hydride compacts - Preparation, properties and use p 88 A83-27338
Metal hydride/chemical heat-pump development project, phase 1
[DE83-002463] p 27 N83-20429

METAL SURFACES

Metallurgical aspects of interstrand resistance --- superconducting magnets
[DE82-005504] p 186 N83-17342

METALLIZING

Development of gas-phase metallized plaques for electrodes of storage batteries, in particular for nickel oxide electrodes
[PB82-255431] p 193 N83-16950
Development of metallization process, FSA project, cell and module formation research area
[NASA-CR-169902] p 63 N83-19220

METALLOGRAPHY

Evaluation of various solar-cell-to-interconnector welds by means of scanning laser acoustic microscopy and metallography
[ESA-STM-225] p 73 N83-21514

METALS

Isolation of metallic complexes in shale oil and shale oil reformation waters
[DE82-005931] p 98 N83-16835
Metal recovery from eastern oil shale
[DE82-004052] p 109 N83-18016
The design, effectiveness and construction of passive-thermal-control roofing shingles
[DE83-001465] p 75 N83-21557

METEOROLOGICAL INSTRUMENTS

Design and standardization of meteorological measurements for wind energy converting systems
[BMFT-FB-T-82-168] p 168 N83-18172

METEOROLOGICAL PARAMETERS

Hybrid solar-wind energy conversion systems meteorological aspects
[DE82-005798] p 61 N83-18053
Inherent uncertainties in meteorological parameters for wind turbine design p 171 N83-19253
Simulation and design of passive processes
[DE82-016647] p 70 N83-20401

METEOROLOGY

Meteorological field measurements at potential and actual wind-turbine sites
[DE83-001493] p 174 N83-19398

METHANATION

Methane synthesis on nickel by a solid-state ionic method p 91 A83-22324
Catalytic behavior in biomass gasification --- wood
[DE82-006164] p 110 N83-18057
Gasification of land-based biomass
[PB83-109918] p 122 N83-19946

METHANE

The influence of large-scale advection on the vertical distribution of stratospheric source gases in 44 degree and 41 degree north p 1 A83-20224
Experimental investigation of shock initiated methane-combustion near a wall p 93 A83-26200
Thermodynamic properties for natural gas binaries
[PB82-254616] p 98 N83-16566
Landfill gas to electricity demonstration project
[PB82-255290] p 7 N83-16943
Methane hydrate gas production An assessment of conventional production technology as applied to hydrate gas recovery
[DE82-006746] p 107 N83-17742
Catalytic gasification of biomass
[DE82-005877] p 110 N83-18058
Methane from landfills Preliminary assessment workbook
[DE83-002319] p 111 N83-18075
Development of a continuous methane monitor
[PB82-244245] p 114 N83-19078
Flame acceleration mechanisms under conditions of partial confinement
[PB83-109884] p 120 N83-19881
Liquid-phase methanol process development unit Installation, operation, and support studies
[DE82-012725] p 121 N83-19940
Energy-efficient alcohol-fuel production
[DE82-011278] p 122 N83-19944
SNG from land-based biomass 1981 program
[PB83-10467] p 125 N83-20440
Dissolved methane concentrations in the southeast Bering Sea, 1980 and 1981
[PB83-112433] p 29 N83-20525
Reformed methanol p 129 N83-21176
Safe handling and testing of alternative fuels
[DE82-009176] p 89 N83-21183

Assessment of methane-related fuels for automotive fleet vehicles Volume 1 Executive summary
[DE83-000280] p 130 N83-21185

Assessment of methane-related fuels for automotive fleet vehicles Volume 2 Technical, supply and economic assessments
[DE82-013287] p 142 N83-22467

Assessment of methane-related fuels for automotive fleet vehicles Volume 3 Appendices
[DE82-013190] p 142 N83-22468

Marine biomass New York state site and species study compositional analysis and systems studies
[PB83-126078] p 142 N83-22470

Development of the utilization of combustible gas produced in existing sanitary landfills Effects of corrosion at the Mountain View, California landfill gas-recovery plant
[DE83-001576] p 145 N83-22769

Methanol production from fermentor off-gases
[DE83-005011] p 145 N83-22793

Dynamic simulation of Exxon's Catalytic Coal-Gasification process
[DE82-021973] p 146 N83-22823

Methane Hydrates Workshop Technical Proceedings
[DE83-000580] p 147 N83-22825

METHYL ALCOHOLS

Investigation of methanol as a boiler fuel for electric-power generation
[DE82-905495] p 97 N83-16560

Methanol synthesis gas from catalytic steam reforming of wood
[DE82-006082] p 106 N83-17734

Catalytic gasification of biomass
[DE82-005877] p 110 N83-18058

Hybrid fuel cell/diesel generation total energy system, part 2
[NASA-CR-169912] p 115 N83-19217

Combustion engine system
[NASA-CASE-NPO-14565-2] p 89 N83-19826

Fleet experience using a methanol/unleaded gasoline blend
[DE83-003834] p 129 N83-21171

Energy inputs and outputs of fuel-alcohol production, summary volume
[DE83-000367] p 129 N83-21174

Energy inputs and outputs of fuel-alcohol production, appendices G and H Methanol from coal
[DE83-000370] p 130 N83-21177

Underground Coal Gasification (UCG) gas to methanol and MTG-gasoline An economic and sensitivity study, task B
[DE83-004320] p 146 N83-22821

Characterization of exhaust emissions from methanol- and gasoline-fueled automobiles
[PB83-116830] p 149 N83-23249

METHYL COMPOUNDS

Organic rankine cycle coupled to a solar pond by direct-contact heat exchange - selection of a working fluid
[DE82-020998] p 57 N83-16900

MEXICO

Lithology and hydrothermal alteration determination from well logs for the Cerro Prieto Wells, Mexico
[DE82-004677] p 101 N83-17000

MICROCLIMATOLOGY

Use of vegetation to ameliorate building microclimates An assessment of energy-conservation potentials
[DE82-013255] p 32 N83-21572

MICROORGANISMS

Microorganisms for fermentation of crop residues
[DE82-006912] p 102 N83-17051

MICROPROCESSORS

Application of microprocessor-based controls in an ac/dc power conversion system p 188 N83-27151

A microprocessor-controlled photovoltaic-array loading unit
[DE83-000797] p 75 N83-21556

MICROSCOPES

Energy and Technology Review
[DE82-011840] p 164 N83-16922

MICROSTRUCTURE

Variation in the microstructure of electrodeposited black chrome solar coatings
[DE81-030842] p 56 N83-16878

MICROWAVE EQUIPMENT

Initial utility experience with cluster of three Mod-2 wind turbine systems p 173 N83-19268

Performance simulation of the JPL solar-powered distiller Part 1 Quasi-steady-state conditions --- for cooling microwave equipment p 66 N83-19781

Coal desulfurization by a microwave process
[DE82-007514] p 118 N83-19854

Review of Thawtron device for thawing frozen coal
[DE82-903145] p 123 N83-20330

MICROWAVE TRANSMISSION

Optimization technique for improved microwave transmission from multi-solar power satellites
p 185 N83-27152

MICROWAVES

The response of solar cells to microwave radiation [AD-A121813] p 64 N83-19279

Coal desulfurization by a microwave process
[DE82-007514] p 118 N83-19854

Feasibility of applications of microwave technology for nuclear power plant radioactive wastes
[DE82-903143] p 29 N83-20744

MILITARY OPERATIONS

Energy optimization in DOD facilities
[DE82-008108] p 7 N83-16925

MILITARY SPACECRAFT

Spacecraft power technology p 153 N83-27157

MILLING (MACHINING)

Uranium p 143 N83-22677

MINERAL DEPOSITS

A study of the United States coal resources [NASA-CR-169792] p 101 N83-16993

Energy development on Native American lands Resources and attitudes An interpretive report on two major Indian conferences of 1980
[DE82-009539] p 17 N83-18076

Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197

MINERAL EXPLORATION

Survey of lands held for uranium exploration, development and production in fourteen western states for the six-month period ending June 30, 1981
[DE82-006228] p 99 N83-16838

The importance of satisfactory positioning, diving and mapping systems, suitable for exploration and transportation in ice-covered sea areas
[FOA-B-60003-M7] p 107 N83-17999

Perspectives in Geology Invited papers presented at a symposium in observance of the 75th anniversary of the Illinois State Geological Survey
[PB-255589] p 112 N83-18138

Perspectives in non-fuel minerals p 112 N83-18143

MINERAL OILS

Association-solvation characteristic of fuels and lubricating and hydraulic oils
[NASA-TM-76957] p 96 N83-16525

MINERALS

Uranium hydrogeochemical and stream sediment reconnaissance of the St Michael NTMS quadrangle, Alaska
[DE82-009999] p 99 N83-16844

The importance of satisfactory positioning, diving and mapping systems, suitable for exploration and transportation in ice-covered sea areas
[FOA-B-60003-M7] p 107 N83-17999

Application of energy dispersive X-ray fluorescence, ion sensitive electrodes and instrumental neutron activation in geochemical prospecting
[BMFT-FB-T-82-152] p 111 N83-18123

Problems in organic geochemistry applied to petroleum exploration and production p 144 N83-22765

Utilization of oil shales and basic research in organic geochemistry p 144 N83-22766

The relevance of coal geochemistry to coal utilization p 144 N83-22767

MINES (EXCAVATIONS)

Mine personnel locator and mine activity controller [PB82-235979] p 200 N83-19315

Alaskan coal Resources and developmental constraints
[DE83-000860] p 130 N83-21494

Preliminary design study of compressed-air energy storage in a salt dome Volume 6 CAES plant design
[DE82-014355] p 196 N83-21580

Future landscapes of the Colorado plateau Impacts of energy development
[DE83-900473] p 34 N83-21666

Coal p 143 N83-22675

MINING

Using peat for energy: Potential environmental restraints Overview
[DE82-005201] p 5 N83-16876

Design of highwall mining equipment electronic guidance package
[DE82-006115] p 108 N83-18005

Western oil-shale development, a technology assessment Volume 6 Oil-shale development in the Piceance Creek Basin and potential water-quality changes
[DE82-005659] p 108 N83-18009

Energy development on Native American lands Resources and attitudes An interpretive report on two major Indian conferences of 1980
[DE82-009539] p 17 N83-18076

Coal geology Who needs it? p 112 N83-18140

Development of a continuous methane monitor [PB82-244245] p 114 N83-19078

A clean internal combustion engine for underground mining machinery A technical assessment and program plan, phase 1
[PB82-244724] p 89 N83-19104

Automation of the longwall mining system [NASA-CR-169933] p 114 N83-19183

High production shuttle car system for coal mines [NASA-CASE-NPO-15949-1] p 187 N83-20155

Uranium p 143 N83-22677

MINORITY CARRIERS

Effect of grain boundaries on the minority carrier diffusion length in InP solar cells p 40 N83-22908

A model for the collection of minority carriers generated in the depletion region of a Schottky barrier solar cell p 40 N83-22910

MIRRORS

Stability of reflectors with polymers coatings
[DE82-007774] p 60 N83-17723

Testing and evaluation of second-generation heliostat mirror modules
[DE82-007934] p 77 N83-21582

Stress analysis of spherical mirror panels
[DE82-015656] p 77 N83-21585

Performance testing of the Acurex solar collector model 3001-03
[DE82-013389] p 77 N83-21603

MIS (SEMICONDUCTORS)

Al-Si peaked Schottky barriers p 40 N83-22903

Metal-insulator-semiconductor silicon solar cells p 44 N83-25447

MISSILE SILOS

Configuration selection study for isolated loads --- using parabolic dish modules to supply power for MX shelters p 41 N83-23137

MIXTURES

Fleet experience using a methanol/unleaded gasoline blend
[DE83-003834] p 129 N83-21171

Oil/refuse homogenization An approach to combustion of refuse in existing oil-fired boilers
[DE82-011848] p 138 N83-22353

MOBILITY

Linear oil displacement by the emulsion entrapment process
[DE82-007751] p 99 N83-16841

MODAL RESPONSE

Finite-element analysis and modal testing of a rotating wind turbine
[DE83-002609] p 180 N83-21608

MODELS

Modeling water supply for the energy sector p 25 N83-20336

Review of hot-gas-desulfurization simulation models
[DE82-016265] p 138 N83-22356

MODULES

Photovoltaic cell and module status assessment Volume 2 Technology basis
[DE83-900575] p 79 N83-21627

Photovoltaic cell and module status assessment Volume 1 Technology overview
[DE83-900567] p 82 N83-22791

MOLDING MATERIALS

Compression molded energy storage flywheels p 189 N83-27303

MOLECULAR ORBITALS

The uranyl ion, fluorescent and fluorine-like - A review p 45 N83-26061

MOLECULAR STRUCTURE

Effect of molecular structure on incipient soot formation p 90 N83-19847

MOLTEN SALT ELECTROLYTES

Molten carbonate fuel cell performance model p 149 N83-19884

Simple porous electrode models for molten carbonate fuel cells p 149 N83-19891

The equilibrium constant for the reversible reaction $H_2S + 3H_2O + 1/2O_2 \rightleftharpoons 3H_2 + CO_2 + 1/2O_2$ at elevated temperature --- in molten carbonate fuel cells p 150 N83-20590

Porous perovskite electrode as molten carbonate cathode --- in fuel cells p 150 N83-20596

Coating applications for the molten carbonate fuel cell p 153 N83-25538

Physical chemistry of molten-salt batteries Current-induced composition gradients in molten LiCl-KCl
[DE83-001684] p 192 N83-16875

MOLTEN SALTS

Direct-contact air/molten salt heat exchange for solar thermal systems p 47 N83-27234

High-temperature molten salt solar thermal systems p 51 N83-27317

- Thermal-convective-loop correction tests of 316SS and IN800 in molten nitrate salts
[DE82-012313] p 66 N83-19898
- Manufacture, distribution, and handling of nitrate salts for solar-thermal applications
[DE83-003317] p 79 N83-21625
- Thermal-convection-loop study of the corrosion of Fe-Ni-Cr alloys by molten NaNO₂/sub 3-KNO₃/sub 3
[DE83-004228] p 80 N83-22407

MOLYBDENUM

- Chemically vapor-deposited black molybdenum films of high IR reflectance and significant solar absorptance
p 44 A83-25534

MOLYBDENUM ALLOYS

- Evaluation of deterioration due to hot creep in chrome-molybdenum ferritic steels used in thermal power stations
[BLL-CE-TRANS-7669-9022 09] p 162 N83-16470

MOLYBDENUM COMPOUNDS

- Catalytic coal liquefaction
[DE82-012562] p 139 N83-22363

MONITORS

- Development of a continuous methane monitor
[PB82-244245] p 114 N83-19078
- Monitoring well systems in geothermal areas
[DE82-012770] p 133 N83-21586
- The HFEM monitoring of coal gasification Rawlins, Wyoming
[DE82-013801] p 142 N83-22466

MOTION PICTURES

- Alternative engine fuels Educational demonstration project
[DE83-004579] p 141 N83-22462

MOTOR VEHICLES

- Fibre composite rotor selection and design /Fibre composite flywheel development program for road vehicle applications/
p 190 A83-27307
- Influence of driver behavior on fuel consumption Bibliographic study
[IRT-58] p 11 N83-17086
- Impact of flywheel-energy-storage technology upon taxicab fleet operation in a large metropolitan city
[DE82-002371] p 194 N83-18591
- Ownership and usage of small passenger vehicles Findings from the 1977 National Personal Transportation Study
[DE82-011045] p 20 N83-18592
- Review and evaluation of automotive fuel conservation technologies
[PB83-101139] p 30 N83-20844
- Annual Transportation Convention, volume 2 Session F Energy and Transportation Engineering Session G Transport Planning
[CSIR-S-313-VOL-2] p 37 N83-23212
- Prospects of motor vehicles as a means of transportation and of alternative drives
p 148 N83-23215

MOUNTAINS

- Present and potential use of micro-hydroelectric schemes in remote locations
[DE82-904687] p 26 N83-20411

MUTAGENS

- Identification and mutagenicity of nitrogen-containing polycyclic aromatic compounds in synthetic fuels
[DE82-006173] p 106 N83-17739

MX MISSILE

- Configuration selection study for isolated loads --- using parabolic dish modules to supply power for MX shelters
p 41 A83-23137

N**NASA PROGRAMS**

- The NASA program in Space Energy Conversion Research and Technology
p 160 A83-27326

NATURAL GAS

- Remote-sensing studies of oil-and-gas-bearing territories in the Caspian Basin --- Russian book
p 93 A83-25619
- Thermodynamic properties for natural gas binaries
[PB82-254616] p 98 N83-16565
- Solar/gas Rankine/Rankine-cycle heat pump assessment
[PB82-254863] p 55 N83-16710
- Reservoir engineering transient pressure well testing, and petrophysical analyses of western gas sands
[DE82-004879] p 99 N83-16839
- Evaluation of utility home-energy-audit programs A Wisconsin example
[DE82-008134] p 6 N83-16924
- Catalytic coal gasification An emerging technology for SNG
[DE82-007596] p 104 N83-17676
- Systems analysis of hydrogen supplementation in natural gas pipelines
[DE82-006933] p 89 N83-17740

- Methane hydrate gas production. An assessment of conventional production technology as applied to hydrate gas recovery
[DE82-006746] p 107 N83-17742

- Development of the oil and gas resources of the United Kingdom A report to Parliament by the Secretary of State for Energy
[ISBN-0-11-411123-5] p 14 N83-18017

- Model simplification to examine the interrelationships between coal, gas and oil use
[DE82-007816] p 110 N83-18061

- Competitive assessment of desiccant solar/gas systems for single family residences
[PB82-243825] p 62 N83-18967

- Advanced solar/gas desiccant cooling system
[PB82-243833] p 62 N83-18968

- Vehicle conversion to hybrid gasoline/alternative fuel operation
[NASA-CR-169911] p 115 N83-19216

- Hybrid fuel cell/diesel generation total energy system, part 2
[NASA-CR-169912] p 115 N83-19217

- The development of solar-assisted gas-fired appliances, phase 2
[PB82-231663] p 66 N83-19312

- Pipeline gas from coal Hydrogenation (IGT hydrogasification process)
[DE82-014611] p 121 N83-19941

- The natural gas option New resources and new technologies
[GPO-99-979] p 123 N83-20365

- American technology transfer and Soviet energy planning
[GPO-97-481] p 26 N83-20373

- International energy indicators
[DE82-012504] p 26 N83-20405

- Solar-augmented applications in industry Phase 2 Conceptual designs, volume 1
[PB83-102301] p 72 N83-20441

- Survey of large combustors Alternative fuel burning capabilities of large boilers in 1979
[DE82-008386] p 127 N83-21079

- Safe handling and testing of alternative fuels
[DE82-009176] p 89 N83-21183

- Assessment of methane-related fuels for automotive fleet vehicles Volume 1 Executive summary
[DE83-000280] p 130 N83-21185

- A review of world hydrocarbon resource assessments
[DE83-900732] p 131 N83-21499

- Energy resources in New Mexico Oil and gas, coal, electrical generation, uranium, and geothermal energy
[DE83-900485] p 142 N83-22672

- Oil and gas Electrical generation
p 34 N83-22674
p 143 N83-22676

- Problems in organic geochemistry applied to petroleum exploration and production
p 144 N83-22765

- Development of the utilization of combustible gas produced in existing sanitary landfills Effects of corrosion at the Mountain View, California landfill gas-recovery plant
[DE83-001576] p 145 N83-22769

- Perspective on our energy options
[DE82-005828] p 36 N83-22802

- Development of an advanced solar augmented water heater (for single family home applications)
[PB83-119610] p 84 N83-22842

- A geologic study of the Michigan Basin
[PB83-136291] p 147 N83-22896

- A geologic study of the Raton Basin
[PB83-136275] p 147 N83-22903

NATURAL GAS EXPLORATION

- US petroleum exploration Likely targets 1980 - 2000
p 112 N83-18141

- ERRSAC contributions to the search for Appalachian hydrocarbons
p 114 N83-19155

- A geologic study of the Black Warrior Basin
[PB83-136283] p 147 N83-22904

NEODYMIUM LASERS

- Coatings for laser fusion
[DE82-005698] p 165 N83-17330

NEUTRON ACTIVATION ANALYSIS

- Isolation of metallic complexes in shale oil and shale oil reflow waters
[DE82-005931] p 98 N83-16835

NEVADA

- Geothermal energy in Nevada Development and utilization
[DE83-001783] p 31 N83-21545

NEW MEXICO

- Design and fabrication of a prototype system for photovoltaic residences in the southwest
[DE83-003935] p 72 N83-21200

- Intermediate photovoltaic system application experiment operational performance executive summary Volume 7 Lovington Square Shopping Center, Lovington, New Mexico
[DE82-014649] p 76 N83-21566

- Energy resources in New Mexico Oil and gas, coal, electrical generation, uranium, and geothermal energy
[DE83-900485] p 142 N83-22672

- Role of energy resources in New Mexico
p 34 N83-22673
p 34 N83-22674

- Oil and gas Coal
p 143 N83-22675
p 143 N83-22676

- Electrical generation Uranium
p 143 N83-22677
p 143 N83-22678

NEW YORK

- Gill Harrop, Big Flats, New York solar-energy-system performance evaluation
[DE83-000065] p 57 N83-16895

- Peat-resource estimation in New York State
[DE82-005156] p 108 N83-18007

- DOE small-scale hydroelectric demonstration program F W E Stappenhorst, Inc., Goodyear Lake hydroelectric-generating-station redevelopment
[DE83-003156] p 182 N83-22780

NEW ZEALAND

- Present and potential use of micro-hydroelectric schemes in remote locations
[DE82-904687] p 26 N83-20411

NEWTON-RAPHSON METHOD

- Numerical determination of the configuration of a rotating blade with constant stress --- for vertical axis wind turbines
p 150 A83-22020

NICKEL

- Methane synthesis on nickel by a solid-state ionic method
p 91 A83-22324

- Large nickel alkaline batteries
p 189 A83-27176

- Development of technique for air coating and nickel and copper metallization of solar cells
[NASA-CR-169938] p 63 N83-19222

NICKEL ALLOYS

- Coal-liquefaction-plant fractionation-column corrosion-coupon studies
[DE82-007469] p 139 N83-22360

NICKEL CADMIUM BATTERIES

- Sealed mini-nickel cadmium battery charging techniques, technical investigation report
[AD-A119828] p 192 N83-16860

- Development of a high capacity toroidal Ni/Cd cell
[NASA-CR-169945] p 174 N83-19273

- Study of battery accelerated-testing techniques
[DE82-017125] p 198 N83-22834

NICKEL COMPOUNDS

- Potential biological hazards of nickel arsenides associated with retorting of oil shale Toxic effects of particulate NiSAs₂
[DE82-010978] p 22 N83-19328

NICKEL HYDROGEN BATTERIES

- Pore size engineering applied to starved electrochemical cells and batteries
p 154 A83-27201

NICKEL OXIDES

- Development of gas-phase metallized plaques for electrodes of storage batteries, in particular for nickel oxide electrodes
[PB82-255431] p 193 N83-16950

NICKEL ZINC BATTERIES

- High-cycle-life, high-energy-density nickel-zinc batteries
[DE82-012896] p 195 N83-20376

- Nickel-zinc batteries
[DE83-000208] p 197 N83-22770

NICKEL-IRON BATTERIES

- Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment
[NASA-CR-169801] p 191 N83-16858

NITRATES

- Thermal-convective-loop correction tests of 316SS and IN800 in molten nitrate salts
[DE82-012313] p 66 N83-19898

NITRIC OXIDE

- The origin and nature of 'prompt' nitric oxide in flames
p 1 A83-22344

NITROGEN

- Thermodynamic properties for natural gas binaries
[PB82-254616] p 98 N83-16565

- A preliminary study of environmental parameters associated with the feasibility of a polygeneration plant at Kennedy Space Center
p 11 N83-17365

- Synthetic fuel effects in continuous combustion systems An experimental study of fuel nitrogen conversion in jet-stirred combustions
[DE82-002686] p 103 N83-17646

- Identification and mutagenicity of nitrogen-containing polycyclic aromatic compounds in synthetic fuels
[DE82-006173] p 106 N83-17739

O

- Low-temperature pyrolysis of coal to produce diesel-fuel blends
[DE83-001637] p 126 N83-21076
Summary of recommendations on basic research p 35 N83-22761

NITROGEN OXIDES

- Droplet size effects on NO_x/x₁ formation in a one-dimensional monodisperse spray combustion system
[ASME PAPER 82-JPGC-GT-10] p 93 A83-25268
State-of-the-art combustion modification NO_x control for stationary combustion equipment
[PB82-240201] p 23 N83-19340
Multi-fuel low-NO_x burner development, phase 2
[PB83-126292] p 147 N83-22845

NITROUS OXIDES

- The influence of large-scale advection on the vertical distribution of stratospheric source gases in 44 degree and 41 degree north p 1 A83-20224

NOISE REDUCTION

- The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations --- (Los Angeles) p 11 N83-17459

NONISOTHERMAL PROCESSES

- Molten carbonate fuel cell performance model p 149 A83-19884

NUCLEAR ELECTRIC POWER GENERATION

- Direct conversion nuclear reactor space power systems p 158 A83-27296
International energy indicators
[DE82-012504] p 26 N83-20405
Nuclear power compared with other energy sources A brief comparative study of some of the risks
[BLL-CE-TRANS-7745-(9022 09)] p 31 N83-21501
Reentry thermal testing of a general purpose heat source fueled clad
[DE82-014125] p 184 N83-23146

NUCLEAR ELECTRIC PROPULSION

- Design options for the SP-100 thermoelectric Nuclear Space Power Plant p 160 A83-27327

NUCLEAR ENERGY

- Thermoelectric conversion for space nuclear power p 155 A83-27222

NUCLEAR FUEL REPROCESSING

- Radioisotopes for heat-source applications
[DE83-005045] p 137 N83-21934

NUCLEAR FUELS

- Development of high-temperature liquid metal heat pipes for isothermal irradiation assemblies --- for in-pile tests of UO₂ space reactor fuel configurations p 185 A83-27129
Utilization of the catalyzed-DD fuel cycle in Reversed-Field Pinch Reactors (RFPRs)
[DE82-010425] p 168 N83-18512

NUCLEAR FUSION

- Fusion technology status and requirements
[DE82-010754] p 174 N83-19615
Physics of mirror systems
[DE82-015908] p 176 N83-20770

NUCLEAR POWER PLANTS

- Design options for the SP-100 thermoelectric Nuclear Space Power Plant p 160 A83-27327
Metallurgical investigation of disc cracking in the LP-2 turbine at a nuclear power station
[DE82-906428] p 162 N83-16515
Interim Reliability Evaluation Program (IREP)
[DE82-004132] p 5 N83-16777
A study of bolting problems, tools, and practices in the nuclear industry
[DE82-902203] p 168 N83-19099
Conceptual design study Standard Floating Nuclear Power Plant on inshore site and Modified Floating Nuclear Power plant on upriver site
[DE82-007916] p 174 N83-19595

NUCLEAR POWER REACTORS

- Overview of fusion reactor safety
[DE82-005951] p 166 N83-17331
Environmental radiation surveillance program
[DE82-902009] p 19 N83-18116

NUCLEAR REACTORS

- Is nuclear energy an unacceptable hazard to health?
[DE82-004954] p 9 N83-16961

NUCLEAR RESEARCH

- Tritium transport and control in the FED
[DE82-002592] p 168 N83-18511

NUMERICAL CONTROL

- Preliminary test results for the small community solar power system
[ASME PAPER 82-WA/SOL-30] p 44 A83-25687
Development of management technology for large power systems --- of spacecraft p 46 A83-27147
Application of microprocessor-based controls in an ac/dc power conversion system p 188 A83-27151
A microprocessor-controlled photovoltaic-array loading unit
[DE83-000797] p 75 N83-21556

OCEAN BOTTOM

- Technologies for Measurement While Drilling
[PB82-243858] p 114 N83-18964
Subsea permafrost in Harrison Bay, Alaska An interpretation from seismic data
[AD-A120221] p 125 N83-20479

OCEAN CURRENTS

- The effects of weather systems, currents and coastal processes on major oil spills at sea
[AD-A120221] p 8 N83-16953

OCEAN SURFACE

- The effects of weather systems, currents and coastal processes on major oil spills at sea
[AD-A120221] p 8 N83-16953
Combustion of oil on water An experimental program
[DE82-014598] p 127 N83-21084

OCEAN THERMAL ENERGY CONVERSION

- Ocean thermal-energy conversion p 152 A83-25125
Marine power - Accomplishments of the 1970s p 155 A83-27223
Some ocean engineering considerations in the design of OTEC plants p 155 A83-27224
OTEC plants for today's island market p 156 A83-27227

- Hydraulic air compressor for ocean thermal energy conversion applications
[DE82-005198] p 163 N83-16880

- Ocean thermal energy at the Johns Hopkins University Applied Physics Laboratory
[PB82-257536] p 165 N83-16937
Ocean Thermal Energy Conversion Environmental effects assessment program plan, 1981 - 1985
[PB82-258047] p 165 N83-16941

- The energy of the ocean thermal resource and the second-law efficiency of idealized ocean thermal energy conversion power cycles p 167 N83-18071
Open-cycle systems performance analysis programming guide
[DE82-005696] p 174 N83-19282

- Study of domestic social and economic impacts of Ocean Thermal Energy Conversion (OTEC) commercial development Volume 1 Economic impacts
[DE83-001111] p 21 N83-19291

- Study of domestic social and economic impacts of Ocean Thermal Energy Conversion (OTEC) commercial development Volume 2 Industry profiles
[DE83-001112] p 21 N83-19292

- Performance and stability of the mist-lift process for open-cycle OTEC
[DE82-010881] p 175 N83-20403

- Dynamic interaction between an OTEC power plant and a power grid --- ocean thermal energy conversion
[DE83-002862] p 183 N83-22784

OCEANOGRAPHY

- The non-Federal oceanographic community An overview
[NASA-CR-169802] p 102 N83-17414
Trends in motor gasoline, 1942 - 1981
[DE82-021124] p 96 N83-16550

OFFSHORE ENERGY SOURCES

- NNE-SSW fault system in part of the Gulf of Suez and its bearing on oil exploration p 92 A83-24551
Development of the oil and gas resources of the United Kingdom A report to Parliament by the Secretary of State for Energy
[ISBN-0-11-411123-5] p 14 N83-18017
US petroleum exploration Likely targets 1980 - 2000 p 112 N83-18141

- Technologies for Measurement While Drilling
[PB82-243858] p 114 N83-18964

OIL ADDITIVES

- The effect of the melt heat treatment time on the properties of lithium lubricants with additives p 94 A83-26921

OIL EXPLORATION

- NNE-SSW fault system in part of the Gulf of Suez and its bearing on oil exploration p 92 A83-24551
Remote-sensing studies of oil-and-gas-bearing terrones in the Caspian Basin --- Russian book p 93 A83-25619

- Results of the investigation of the oil and gas deposits of Tadzhikistan on the basis of space photographs p 94 A83-26805

- Operational experiences of a downhole steam generator
[DE82-010161] p 100 N83-16906

- The importance of satisfactory positioning, diving and mapping systems, suitable for exploration and transportation in ice-covered sea areas
[FOA-B-60003-M7] p 107 N83-17999

Project DEEP STEAM

- [DE82-010945] p 111 N83-18078
Perspectives in Geology Invited papers presented at a symposium in observance of the 75th anniversary of the Illinois State Geological Survey
[PB-255589] p 112 N83-18138
US petroleum exploration Likely targets 1980 - 2000 p 112 N83-18141

- ERRSAC contributions to the search for Appalachian hydrocarbons p 114 N83-19155

- Subsea permafrost in Harrison Bay, Alaska An interpretation from seismic data
[AD-A120221] p 125 N83-20479

- Exploration deliberations p 144 N83-22762
Problems in organic geochemistry applied to petroleum exploration and production p 144 N83-22765

OIL FIELDS

- Operational experiences of a downhole steam generator
[DE82-010161] p 100 N83-16906

- Coalinga polymer demonstration project
[DE82-007019] p 105 N83-17726

- Development of the oil and gas resources of the United Kingdom A report to Parliament by the Secretary of State for Energy

- [ISBN-0-11-411123-5] p 14 N83-18017

- Oil and gas p 34 N83-22674

OIL POLLUTION

- The effects of weather systems, currents and coastal processes on major oil spills at sea
[AD-A120221] p 8 N83-16953

- Effects of petroleum on selected uniform substrates A feasibility study
[PB82-255084] p 10 N83-16985

- Petroleum contamination Quantification and passive tagging in organisms and sediments
[PB82-254087] p 113 N83-18880

OIL RECOVERY

- Laser depth sounding for locating oil below water surface A preliminary survey
[FOA-C-30290-E1] p 98 N83-16753

- Linear oil displacement by the emulsion entrapment process
[DE82-007751] p 99 N83-16841

- Operational experiences of a downhole steam generator
[DE82-010161] p 100 N83-16906

- Coalinga polymer demonstration project
[DE82-007019] p 105 N83-17726

- Project DEEP STEAM
[DE82-010945] p 111 N83-18078

- Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States
[DE82-011237] p 18 N83-18108

- Oil and Gas Supply Modeling
[PB82-234139] p 117 N83-19310

- Controlled source audio-magnetotelluric (CSMAT) resistivity measurements for in-situ combustion
[DE82-016398] p 120 N83-19877

- Bartlesville Energy Technology Center enhanced oil recovery project data base
[DE82-012568] p 123 N83-20333

- World oil model development
[DE82-013979] p 25 N83-20334

- The importance of satisfactory positioning, diving and mapping systems suitable for exploration and transportation in icecovered sea areas
[PB83-109587] p 123 N83-20342

- Waste lubricating oil An annotated review, 1982 revision
[DE83-001439] p 30 N83-21156

- Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery
[DE82-008705] p 140 N83-22436

OIL SLICKS

- Laser depth sounding for locating oil below water surface A preliminary survey
[FOA-C-30290-E1] p 98 N83-16753

- The effects of weather systems, currents and coastal processes on major oil spills at sea
[AD-A120221] p 8 N83-16953

- Combustion of oil on water An experimental program
[DE82-014598] p 127 N83-21084

OILS

- The use of slurry fuels in industrial furnaces
[TAE-428] p 106 N83-17729

- Formation/decomposition of condensable hydrocarbons during the gasification of coal
[DE82-014493] p 119 N83-19866

- Economic and engineering evaluation of plant oils as a diesel fuel
[DE83-900805] p 141 N83-22464

- Energy resources in New Mexico Oil and gas, coal, electrical generation, uranium, and geothermal energy
[DE83-900485] p 142 N83-22672

ON-LINE SYSTEMS

- Fossil-energy
[DE83-003817] p 124 N83-20383

ONBOARD DATA PROCESSING

- An on-board near-optimal climb-dash energy management
[NASA-CR-169755] p 4 N83-16329

OPEN CHANNEL FLOW

- Performance and stability of the mist-lift process for open-cycle OTEC
[DE82-010881] p 175 N83-20403

OPEN CIRCUIT VOLTAGE

- Origin of the difference in the open circuit voltage between p-i-n type and n-i-p type hydrogenated amorphous silicon solar cells p 37 N83-19991
Open-circuit voltages across two junctions in n-i-p-p-i solar cells under high illumination levels p 51 N83-27976

OPENINGS

- Ventilated wall and window test passive-solar concept
[DE83-900824] p 78 N83-21614

OPERATING COSTS

- DOE small-scale hydroelectric demonstration program
F W E Stapenhorst, Inc., Goodyear Lake hydroelectric-generating-station redevelopment
[DE83-003156] p 182 N83-22780

OPERATING TEMPERATURE

- Experimental study of the thermal stability of hydrocarbon fuels
[NASA-CR-168027] p 105 N83-17728

OPERATOR PERFORMANCE

- A physiological and hygiene evaluation of the work regime of operators who are working in current energy production in Kirghizia p 4 N83-28765
Influence of driver behavior on fuel consumption
Bibliographic study
[IRT-58] p 11 N83-17086

OPTICAL FILTERS

- Optical measurements p 66 N83-19567

OPTICAL MEASUREMENT

- Optical measurements p 66 N83-19567

OPTICAL MEASURING INSTRUMENTS

- Development and application of advanced diagnostics methods in fossil fuel combustion studies p 90 N83-20436

OPTICAL PROPERTIES

- Effect of argon pressure on the optical properties of sputtered solar selective surfaces p 40 N83-22620
Computer simulation of the optical behaviour of amorphous silicon solar cells p 51 N83-27979
Properties of oxidized copper surfaces for solar applications II p 54 N83-29513
Coatings for laser fusion p 165 N83-17330
Stability of reflectors with polymeric coatings
[DE82-007774] p 60 N83-17723
Solar-absorber-selective paint research
[DE82-006104] p 61 N83-18050
Optical properties of sputtered Si H
[DE82-007072] p 62 N83-18491

OPTICAL RADAR

- Laser depth sounding for locating oil below water surface A preliminary survey
[FOA-C-30290-E1] p 98 N83-16753

OPTICAL WAVEGUIDES

- Light transport in planar luminescent solar concentrators
- The role of DCM self-absorption --- 4-dicyano-methylene-2-methyl-6-p-dimethyl
H-pyran p 39 N83-22619

OPTIMAL CONTROL

- Optimal control of solar heating and off-peak energy storage installations p 42 N83-23882
Control design for a wind turbine-generator using output feedback p 152 N83-24721
Regulation of a system with variable structure --- for boilers of solar powered central receivers p 43 N83-24761
A study of a solar central power plant with a gas turbine - Project Sirocco modelling and control --- French thesis p 53 N83-28652
An on-board near-optimal climb-dash energy management
[NASA-CR-169755] p 4 N83-16329
Long-term energy capture and the effects of optimizing wind turbine operating strategies p 171 N83-19248

OPTIMIZATION

- An optimization of monolithic photovoltaic series arrays p 38 N83-20751
Optimization technique for improved microwave transmission from multi-solar power satellites p 185 N83-27152
Energy optimization in DOD facilities
[DE82-008108] p 7 N83-16925
Optimization of dish solar collectors with and without secondary concentrators
[NASA-CR-169928] p 64 N83-19224

ORBITAL SPACE STATIONS

- Systems and operations - Living with complexity and growth p 86 N83-24357
Thermal control - Heat buses will operate like a public utility p 184 N83-24358
Structures and mechanisms - Streamlining for fuel economy p 2 N83-24361
Comparison of evolving photovoltaic and nuclear power systems for earth orbital applications p 45 N83-27131

ORBITAL WORKSHOPS

- Orbital ring systems and Jacob's Ladders III p 185 N83-29457

ORGANIC CHEMISTRY

- Workshop on the Status of Industrial Organic Electrochemistry, summary p 103 N83-17647
[DE82-901982]
Utilization of oil shales and basic research in organic geochemistry p 144 N83-22766
The relevance of coal geochemistry to coal utilization p 144 N83-22767

ORGANIC COMPOUNDS

- A system of hydrogen-powered vehicles with liquid organic hydrides p 88 N83-27340
Evaluation of tetrafluorethane-1,2-disulfonic acid as a fuel cell electrolyte p 161 N83-28300
Workshop on the Status of Industrial Organic Electrochemistry, summary p 103 N83-17647
[DE82-901982]

ORGANIC SEMICONDUCTORS

- Organic solar cells - A review p 44 N83-25449

ORGANOMETALLIC COMPOUNDS

- The growth of Zn3P2 by metalorganic chemical vapor deposition --- material for low cost photovoltaic devices p 45 N83-26065
Single and multijunction space solar cells grown by organometallic vapor phase epitaxy /OM-VPE/ p 50 N83-27260

OROGRAPHY

- Geology and structures study of the Nuba Mountains, Sudan, using Landsat images p 92 N83-24561

OSCILLATIONS

- Construction, testing and development of large wind energy facilities
[NASA-TM-76933] p 163 N83-16855

OTTO CYCLE

- Possibilities of improving exhaust emissions and energy consumption in mixed hydrogen-gasoline operation p 87 N83-27334

OXIDATION

- The seasonal variation of the atmospheric SO2 to SO4⁻ conversion rate p 2 N83-24279

OXIDATION-REDUCTION REACTIONS

- The photoreduction of water - A study of a model system --- French thesis p 86 N83-22083

OXIDE FILMS

- Al-Si peaked Schottky barriers p 40 N83-22903
High temperature degradation in cobalt oxide selective absorber p 53 N83-28942
Properties of oxidized copper surfaces for solar applications I p 54 N83-29512
Properties of oxidized copper surfaces for solar applications II p 54 N83-29513

OXIDES

- Status of the cadmium thermoelectrochemical hydrogen cycle
[DE83-900088] p 89 N83-22349

OXYGEN

- Corrosion of 310 stainless steel in H2-H2O-H2S gas mixtures Studies at constant temperature and fixed oxygen potential p 90 N83-20265
Identification and removal of the organic compounds in coal-conversion condensate waters
[DE82-004825] p 8 N83-16955
Experimental techniques for the study of photosynthetic water splitting
[DE82-003974] p 89 N83-17668
Selecting and testing oxygen-measuring systems for fluidized-bed combustors
[DE83-005987] p 128 N83-21089
Enriched-air and oxygen gasification of Illinois No 6 coal in a Texaco coal-gasification unit
[DE82-903133] p 139 N83-22362

OXYGEN ISOTOPES

- Oxygen isotope exchange in rocks and minerals from the Cerro Prieto geothermal system Indicators of temperature distribution and fluid flow
[DE82-001077] p 100 N83-16907

OXYGEN PRODUCTION

- A mechanistic study of oxygen evolution on Li-doped Co3O4 --- by electrolysis p 85 N83-20586
Oxygen supply for coal gasification power stations (combined cycle process)
[BMFT-FB-T-82-018] p 131 N83-21505

OXYGEN 18

- Oxygen isotope exchange in rocks and minerals from the Cerro Prieto geothermal system Indicators of temperature distribution and fluid flow
[DE82-001077] p 100 N83-16907

OZONE

- The kinetics and mechanism of the reaction of ozone with sulphides
[BLL-OA-TRANS-1934-(6196 3)] p 94 N83-16411

P

P-I-N JUNCTIONS

- Origin of the difference in the open circuit voltage between p-i-n type and n-i-p type hydrogenated amorphous silicon solar cells p 37 N83-19991
Effect of an SiC layer on p-i-n amorphous silicon solar cells p 40 N83-22909

P-N JUNCTIONS

- A semiconductor-insulator-semiconductor CdO-SiO2-Si solar cell p 41 N83-22912
New materials for solar cells - Tandem cells p 45 N83-26882
Grain boundary effects in polycrystalline silicon solar cells I - Solution of the three-dimensional diffusion equation by the Green's function method II - Numerical calculation of the limiting parameters and maximum efficiency p 52 N83-27981
Diffusion length determination in n-i-p-p-i structure based silicon solar cells from the intensity dependence of the short-circuit current for illumination from the p-i-p side p 52 N83-27982

PAINTS

- Solar-absorber-selective paint research
[DE82-006104] p 61 N83-18050
Optimization of solar-selective paint coatings
[DE83-001278] p 80 N83-21642

PANELS

- Effects of gaps in adhesives that bond elastically deformed panels to parabolic, cylindrical substructures
[DE82-014720] p 72 N83-21154
Intermediate photovoltaic system application experiment operational performance executive summary Volume 7 Lovington Square Shopping Center, Lovington, New Mexico
[DE82-014649] p 76 N83-21566
Design, fabrication and test of liquid metal heat-pipe sandwich panels
[NASA-TM-84631] p 187 N83-22541

PAPER (MATERIAL)

- Design of plywood and paper flywheel rotors
[DE83-002276] p 195 N83-20430

PARABOLIC BODIES

- Contact stresses on a thin plate after large displacements to a half parabolic surface
[DE82-006998] p 63 N83-19136

PARABOLIC REFLECTORS

- Comparison of advanced thermal and electrical storage for parabolic dish solar thermal power systems p 47 N83-27232
Use of parabolic trough collectors for residential/light commercial solar cooling systems p 48 N83-27245
Large parabolic dish collectors with small gas-turbine, Stirling engine or photovoltaic power conversion systems p 160 N83-27329
Deformation of a thin, elastic plate to a deep parabolic cylinder
[DE82-012056] p 72 N83-21413
Engineering development studies for integrated evacuated CPC arrays
[DE82-013941] p 77 N83-21583

PARABOLOID MIRRORS

- Evaluation of solar reflective surfaces for dish concentrators p 48 N83-27237

PARTICLE SIZE DISTRIBUTION

- Characteristics of coal/light hydrocarbon slurries in spray combustion
[DE82-006294] p 102 N83-17639
Fractionation of an oil shale retort process water isolation of photoactive genotoxic components
[DE82-010428] p 108 N83-18014
Diffusion flame studies of the chemical and physical mechanisms of soot formation from aromatic and substituted aromatic fuels p 120 N83-19879
Low-temperature pyrolysis of coal to produce diesel-fuel blends
[DE83-001637] p 126 N83-21076

PASTES

- Development of metallization process, FSA project, cell and module formation research area
[NASA-CR-169902] p 63 N83-19220

PAYLOAD TRANSFER

- Orbital ring systems and Jacob's Ladders III p 185 N83-29457

PAYLOADS

PAYLOADS

- Fourth ESTEC spacecraft power-conditioning seminar
[ESA-SP-186] p 176 N83-21006

PEAT

- Using peat for energy Potential environmental restraints Overview p 5 N83-16876
Relationship between pyrite formation and organic sulfur content of coal as revealed by electron microscopy [DE82-010417] p 104 N83-17652
Peat-resource estimation in New York State [DE82-005156] p 108 N83-18007
Preliminary evaluation of environmental issues on the use of peat as an energy source [DE83-000820] p 34 N83-21651

PENINSULAS

- Preliminary geothermal evaluation of the Mokapu Peninsula on the Island of Oahu, Hawaii [AD-A119158] p 117 N83-19378

PERFORMANCE

- Performance and load data from Mod-0A and Mod-1 wind turbine generators p 171 N83-19255

PERFORMANCE PREDICTION

- Molten carbonate fuel cell performance model p 149 A83-19884
A method of evaluating and sizing solar cogeneration systems p 41 A83-23127
Transient characteristics of flat-plate solar collector p 42 A83-23333
f-Chart - Predictions and measurements --- of solar heating systems p 42 A83-23880
Modeling and evaluation of designs for solid hydrogen storage beds p 87 A83-27333
A probability density function for the clearness index, with applications p 53 A83-28938
The multiple layer solar collector p 53 A83-28940
Analytical investigation of critical MHD phenomena [NASA-CR-168079] p 169 N83-19228
Open-cycle systems performance analysis programming guide [DE82-005696] p 174 N83-19282
User's manual for heat-pump Seasonal-Performance Model (SPM) with selected parametric examples [DE83-002455] p 31 N83-21552
User's manual for steady-state computer simulation for air-to-air heat pumps with selected examples [DE83-002446] p 32 N83-21553
Synthetic fuels for transportation Background paper 1 The future potential of electric and hybrid vehicles [PB83-126086] p 37 N83-23250

PERFORMANCE TESTS

- The simulation of global radiation p 37 A83-20139
EA study of solar concentrator panels with fluorescent compounds p 40 A83-22911
Aerodynamic tests of Darrieus wind turbine blades p 151 A83-23128
The results of an experimental investigation of the effect of vibration loading parameters on the working characteristics of heat pipes p 184 A83-23924
Preliminary test results for the small community solar power system [ASME PAPER 82-WA/SOL-30] p 44 A83-25687
Development of high-temperature liquid metal heat pipes for isothermal irradiation assemblies --- for in-pile tests of UO₂ space reactor fuel configurations p 185 A83-27129
Contemporary electric vehicle testing and evaluation p 3 A83-27160
Development of a Stirling engine rod seal p 158 A83-27294
Thermionic converters for terrestrial applications p 159 A83-27299
Twin disk composite flywheel p 189 A83-27304
On aerodynamic design of the Savonius windmill rotor p 160 A83-27325
Metallurgical investigation of disc cracking in the LP-2 turbine at a nuclear power station [DE82-906428] p 162 N83-16515
Thermal performance case studies for residential solar heating and cooling systems [PB82-260100] p 59 N83-16940
Fixed pitch rotor performance of large horizontal axis wind turbines p 169 N83-19233
Stall induced instability of a teetered rotor p 169 N83-19234
Free yaw performance of the Mod-0 large horizontal axis 100 kW wind turbine p 170 N83-19235
Multiple and variable speed electrical generator systems for large wind turbines p 170 N83-19236
Assessing the representativeness of wind data for wind turbine site evaluation p 116 N83-19239
Fiberglass composite blades for the 2 MW Mod-1 wind turbine generator p 170 N83-19241
Development tests for the 2.5 megawatt Mod-2 wind turbine generator p 172 N83-19260

- An overview of large wind turbine tests by electric utilities p 172 N83-19265
Initial utility experience with cluster of three Mod-2 wind turbine systems p 173 N83-19268
Conceptual design and performance analysis of absorption heat pumps for waste-heat utilization [DE82-010202] p 186 N83-20060
Selecting and testing oxygen-measuring systems for fluidized-bed combustors [DE83-005987] p 128 N83-21089
Technology of elevated voltage solar arrays Key items test and evaluation Part 2 Simulated LEO-plasma tests [ESA-CR(P)-1646] p 73 N83-21513
Enhancement of energy savings through accelerated implementation of high-performance forge furnaces [DE82-010913] p 32 N83-21578
Performance testing of the Acurex solar collector model 3001-03 [DE82-013389] p 77 N83-21603
Results of the PRDA 35 qualification tests of the BDM concentrating photovoltaic module [DE83-002136] p 78 N83-21613
Tests of an alternating current propulsion subsystem for electric vehicles on a road load simulator [NASA-TM-83036] p 182 N83-22749
Reentry thermal testing of light-weight radioisotope heater unit [DE82-014116] p 148 N83-23147
- PERIODIC VARIATIONS**
Rymark 1, Rymark 2, and Rymark 3, Fredenck, Maryland Solar-energy-system performance evaluation, May 1981 through March 1982 [DE83-000067] p 57 N83-16890
Contemporary Systems, Inc., Walpole, New Hampshire solar-energy-system performance evaluation [DE83-000068] p 57 N83-16894
Gill Harrop, Big Flats, New York solar-energy-system performance evaluation [DE83-000065] p 57 N83-16895
Intermediate photovoltaic system application experiment operational performance report for Lovington Square Shopping Center, Lovington, New Mexico [DE83-000391] p 57 N83-16896
Intermediate photovoltaic system application experiment operational performance report Volume 6 Beverly High School, Beverly, Mass [DE82-014710] p 69 N83-20391
The effects of atmospheric variability on energy utilization and conservation [DE83-003612] p 31 N83-21525
- PERMAFROST**
Subsea permafrost in Harrison Bay, Alaska An interpretation from seismic data [AD-A121020] p 125 N83-20479
- PERMEABILITY**
Reservoir engineering transient pressure well testing, and petrophysical analyses of western gas sands [DE82-004879] p 99 N83-16839
Linear oil displacement by the emulsion entrapment process [DE82-007751] p 99 N83-16841
Type-curve analysis of pressure buildup from vertically fractured wells in low permeability reservoirs [DE82-010513] p 115 N83-19198
A geologic study of the Raton Basin [PB83-136275] p 147 N83-22903
- PEROVSKITES**
Porous perovskite electrode as molten carbonate cathode --- in fuel cells p 150 A83-20596
- PETROGRAPHY**
Relationships between coal constitution, thermoplastic properties and liquefaction behavior of coals and vitrinite concentrates from the lower Kittanning seam, part 1 [DE82-012848] p 118 N83-19860
- PETROLEUM PRODUCTS**
South Carolina energy outlook [DE83-002121] p 32 N83-21561
World petroleum outlook, 1982 [GPO-95-066] p 35 N83-22753
Workshop report on Basic Research in Organic Geochemistry Applied to National Energy Needs [DE82-007074] p 144 N83-22760
Summary of recommendations on basic research p 35 N83-22761
Exploration deliberations p 144 N83-22762
Problems in organic geochemistry applied to petroleum exploration and production p 144 N83-22765
Conversion of coal to synthetic fuels p 144 N83-22768
- PHASE CHANGE MATERIALS**
Performance of a cylindrical phase-change thermal energy storage unit p 191 A83-28969
An analysis of selected surface characteristics and latent heat storage for passive solar space heating [DE82-006932] p 61 N83-18049
- Fundamental heat-transfer processes related to phase-change thermal-storage media [DE83-002205] p 196 N83-21639
- PHASE TRANSFORMATIONS**
Performance of a cylindrical phase-change thermal energy storage unit p 191 A83-28969
Phase equilibrium properties of coal derived liquids [DE82-007006] p 102 N83-17638
- PHENOLS**
Formation/decomposition of condensable hydrocarbons during the gasification of coal [DE82-014493] p 119 N83-19866
- PHOSPHATES**
Chalcogenophosphate photoelectrodes [NASA-CASE-LAR-12958-1] p 60 N83-18025
- PHOSPHIDES**
The growth of Zn₃P₂ by metalorganic chemical vapor deposition --- material for low cost photovoltaic devices p 45 A83-26065
- PHOSPHORESCENCE**
Use of inorganic materials for phosphorescent concentrating solar cells [DE83-002860] p 83 N83-22799
- PHOSPHORIC ACID**
The structure of the double layer at the mercury-phosphoric acid interface from studies of adsorption of thiourea and its implications on oxygen reduction kinetics --- in fuel cells p 149 A83-19876
- PHOSPHORIC ACID FUEL CELLS**
Assessment of phosphoric acid and trifluoromethane sulfonic acid fuel cells for vehicular powerplants p 154 A83-27162
Fuel cell electrolyte for portable electrical generating equipment [AD-A121176] p 174 N83-19275
Prospects for the development of non-noble metal catalysts for hydrogen-air fuel cells [DE82-013875] p 176 N83-20422
Feasibility evaluation of fuel cells for selected heavy-duty transportation systems p 179 N83-21550
Fuel-cell-propelled submarine-tanker-system study [DE82-015149] p 183 N83-22827
- PHOTOCHEMICAL REACTIONS**
The photoreduction of water - A study of a model system --- French thesis p 86 A83-22083
Photochemical storage potential of azobenzenes p 191 A83-28941
- PHOTOCONDUCTIVITY**
Photoconductivity and photovoltaic effect in indium selenide p 39 A83-22337
- PHOTODECOMPOSITION**
Photo-induced electron-transfer reactions in heterogeneous media [DE82-005767] p 66 N83-19627
- PHOTOELECTRIC CELLS**
Investigation of intercalated compounds for photoelectrochemical energy storage [DE83-000543] p 192 N83-16899
Additional testing of the passive heat-pipe-cooled solar photovoltaic receiver [DE-83-004474] p 78 N83-21615
Electric power from orbit A critique of a satellite power system [DE83-002771] p 33 N83-21619
- PHOTOELECTROCHEMICAL DEVICES**
Electrophoretically deposited CdS and CdSe anodes for photoelectrochemical cells p 149 A83-19883
Electrochemical solar cells using CdSe thin film electrodes p 37 A83-19885
Chemical bath deposition of thin film cadmium selenide for photoelectrochemical cells p 38 A83-20594
Photoelectrochemical behaviour of electrodeposited and pressure-sintered Bi₂S₃, Bi₂S₃-PbS and Bi₂S₃-Ag₂S semiconductor electrodes p 40 A83-22905
Factors affecting the efficiency of chemically deposited CdSe based photoelectrochemical cells p 54 A83-29514
- PHOTOELECTROCHEMISTRY**
Photoelectrolysis of water under visible light with doped SrTiO₃ electrodes p 38 A83-20580
Photoelectrochemical processes in bismuth germanium oxide, Bi₂GeO₂₀ single crystals p 38 A83-20581
Semiconductor photoelectrochemistry [NASA-TP-2088] p 167 N83-18024
- PHOTO GEOLOGY**
Tectonic elements registered on the Landsat imagery in area of Yugoslavia and their practical meaning p 91 A83-21945
Geology and structures study of the Nuba Mountains, Sudan, using Landsat images p 92 A83-24561
Remote-sensing studies of oil-and-gas-bearing terrones in the Caspian Basin --- Russian book p 93 A83-25619

SUBJECT INDEX

PHOTOLYSIS

- Photo-induced electron-transfer reactions in heterogeneous media
[DE82-005767] p 66 N83-19627

PHOTOMAPPING

- Results of the investigation of the oil and gas deposits of Tadjikistan on the basis of space photographs
p 94 A83-26805

PHOTONS

- Research needs Prime-power for high energy space systems
[AD-A120209] p 163 N83-16861

PHOTOPRODUCTION

- Photobiology task of the advanced solar energy research program
[DE82-012310] p 71 N83-20417

PHOTOSENSITIVITY

- Photoelectrochemical behaviour of electrodeposited and pressure-sintered Bi₂S₃, Bi₂S₃-PbS and Bi₂S₃-Ag₂S semiconductor electrodes
p 40 A83-22905

PHOTOSYNTHESIS

- Solar power applications - Alcohols
p 39 A83-21066
- Experimental techniques for the study of photosynthetic water splitting
[DE82-003974] p 89 N83-17668

PHOTOTHERMAL CONVERSION

- Area utilization efficiency of a sloping heliostat system for solar concentration
p 39 A83-22618
- Improved thermophotovoltaic power system
p 46 A83-27139

Solar thermionic energy converter experiment

- p 51 A83-27301
- Thermal energy storage - Air Force user considerations in various modes of operation
p 190 A83-27305

PHOTOVOLTAGES

- Effect of grain boundaries on the minority carrier diffusion length in InP solar cells
p 40 A83-22908
- Intermediate photovoltaic system application experiment operational performance report Volume 5 For CDC Light Manufacturing Building, San Bernardino, California, for July 1982
p 73 N83-21517
- Photovoltaic off-farm agricultural applications Volume 2 Technical report
[DE82-009320] p 76 N83-21562

PHOTOVOLTAIC CELLS

- Status of photovoltaic materials and process technologies
p 38 A83-20435
- An optimization of monolithic photovoltaic series arrays
p 38 A83-20751
- Metal-insulator-semiconductor silicon solar cells
p 44 A83-25447
- New materials for solar cells - Tandem cells
p 45 A83-26882
- Performance degradation and cleaning of photovoltaic arrays
p 48 A83-27236
- On insulation measurements using pyranometers and solar cell devices
p 48 A83-27238
- Design of large, low-concentration-ratio solar arrays for low earth orbit applications
p 49 A83-27254
- The fill factor of a solar cell from a mathematical point of view
p 52 A83-27986
- A method for producing heat pipes for cooling semiconductor photovoltaic cells and the heat pipe characteristics
p 52 A83-28366
- Design and fabrication of a prototype system for photovoltaic residences in the Northeast
p 55 N83-16872
- Renewable energy system feasibility study
[AD-A121252] p 15 N83-18035
- Application of laser annealing and laser-induced diffusion to photovoltaic conversion
p 61 N83-18056
- Startup experience with a concentrating photovoltaic power system
[DE82-008833] p 62 N83-18069
- Photovoltaic array Power conditioner interface characteristics
[NASA-CR-169919] p 64 N83-19225
- Intermediate photovoltaic system application experiment operational performance report Volume 5 for Lovington Square Shopping Center, Lovington, NM
[DE82-006877] p 65 N83-19286
- Initial detailed designs for intermediate photovoltaic systems Branch bank
[DE82-005854] p 65 N83-19287
- Intermediate photovoltaic system application experiment operational performance report Volume 3 For Mississippi County Community College, Blytheville, Arkansas
[DE83-000072] p 65 N83-19293
- Analysis and design of residential load centers Volume 2 Appendices
[DE82-014253] p 24 N83-19956
- Airport solar photovoltaic concentrator
[DE83-003137] p 68 N83-20384

Photovoltaic-concentrator technology in the USA

- [DE82-016399] p 68 N83-20387
- Design, testing, and economics of a 430 W sub p photovoltaic concentrator array for non grid-connected applications
[DE82-014687] p 68 N83-20388
- Analysis of temperature data from Martin Manetta solar photovoltaic array
[DE82-014258] p 69 N83-20389
- Intermediate photovoltaic system application experiment operational performance report Volume 6 Beverly High School, Beverly, Mass
[DE82-014710] p 69 N83-20391
- Photovoltaic subsystem optimization and design tradeoff study
[DE82-013393] p 69 N83-20392
- Photovoltaic retrofit feasibility in the United States
[DE82-014508] p 69 N83-20393
- Design of a photovoltaic system for a southeast all-electric residence
[DE82-009349] p 69 N83-20394
- Initial detailed designs for intermediate photovoltaic systems Warehouse
[DE82-014534] p 69 N83-20396
- Photovoltaic off-farm agricultural applications Volume 1 Executive summary
[DE82-008487] p 70 N83-20398
- Photovoltaic/thermal collector development program
[DE82-012572] p 71 N83-20416
- Design and development of monolithic acrylic Fresnel lenses for use in point-focus PV systems
[DE82-007554] p 72 N83-20768
- Design and fabrication of a prototype system for photovoltaic residences in the southwest
[DE83-003935] p 72 N83-21200
- Study of installed and life-cycle costs for batteries in photovoltaic power systems
[DE83-003849] p 74 N83-21522
- Intermediate photovoltaic system application experiment operational performance report Volume 2 G N Wilcox Memorial Hospital, Kauai, Hawaii
[DE83-002139] p 74 N83-21541
- Assessment of distributed photovoltaic electric-power systems
[DE83-000531] p 75 N83-21558
- Intermediate photovoltaic system application experiment operational performance report Volume 5 Beverly High School, Beverly Massachusetts, Executive summary
[DE82-014711] p 76 N83-21563
- Intermediate photovoltaic system application experiment operational executive summary Volume 7 Newman Power Station, El Paso, Texas
[DE82-014647] p 76 N83-21564
- Advanced photovoltaic-trough development
[DE82-015646] p 77 N83-21584
- Intermediate photovoltaic system application experiment operational performance report for CDC Light Manufacturing Building, San Bernardino, California
[DE83-002529] p 78 N83-21605
- Intermediate photovoltaic system application experiment operational performance report for Oklahoma Center for Science and Arts for June, July, and August 1982
[DE83-003668] p 78 N83-21606
- Design and fabrication of a prototype system for photovoltaic residences in the southwestern United States
[DE83-002532] p 78 N83-21607
- Results of the PRDA 35 qualification tests of the BDM concentrating photovoltaic module
[DE83-002136] p 78 N83-21613
- Photovoltaic cell and module status assessment Volume 2 Technology basis
[DE83-000575] p 79 N83-21627
- Design and demonstration of a spectrum-splitting photovoltaic concentrator module
[DE83-003669] p 79 N83-21634
- Intermediate photovoltaic system application experiment operational performance report Volume 5, for Beverly High School, Beverly, Mass
[DE82-012058] p 81 N83-22774
- Assessment of distributed photovoltaic electric-power systems
[DE83-000566] p 187 N83-22788
- Photovoltaic cell and module status assessment Volume 1 Technology overview
[DE83-000567] p 82 N83-22791
- Automated installation methods for photovoltaic arrays
[DE83-004272] p 82 N83-22796
- Performance optimization of the ASR optical module
[DE83-004477] p 82 N83-22797
- Photovoltaic advanced research and development program in the United States
[DE83-000307] p 83 N83-22814

- Intermediate photovoltaic system application experiment operational performance report Volume 1 Dallas - Fort Worth Regional Airport, Texas, July 1982
[DE83-004763] p 84 N83-22819
- Intermediate photovoltaic system experiment operational performance report Volume 3 For G N Wilcox Memorial Hospital, Kauai, Hawaii
[DE83-000801] p 84 N83-22830

PHOTOVOLTAIC CONVERSION

- Sunshine project solar photovoltaic program and recent activities in Japan
p 37 A83-20137
- Solar power applications - Alcohols
p 39 A83-21066
- Progress in photovoltaic energy conversion
p 42 A83-23859
- Electric power - Looking at regenerative systems
p 43 A83-24353
- The growth of Zn₃P₂ by metalorganic chemical vapor deposition --- material for low cost photovoltaic devices
p 45 A83-26065
- Companson of evolving photovoltaic and nuclear power systems for earth orbital applications
p 45 A83-27131
- Improved thermophotovoltaic power system
p 46 A83-27139
- Operational results from the Saudi solar village photovoltaic power system
p 48 A83-27240
- Space solar cell technology development - A perspective
p 49 A83-27255
- Large parabolic dish collectors with small gas-turbine, Stirling engine or photovoltaic power conversion systems
p 160 A83-27329
- Grain boundary effects in polycrystalline silicon solar cells I - Solution of the three-dimensional diffusion equation by the Green's function method II - Numerical calculation of the limiting parameters and maximum efficiency
p 52 A83-27981
- Diffusion length determination in n+/p-p+/p+ structure based silicon solar cells from the intensity dependence of the short-circuit current for illumination from the p+/side
p 52 A83-27982
- Concentrator systems in photovoltaic conversion - Assessment and perspectives --- French thesis
p 53 A83-28653
- Solar-photovoltaic power for broadcasting stations An economic analysis
[DE82-022498] p 55 N83-16873
- Performance of an experimental photovoltaic-powered house
[DE82-000662] p 58 N83-16908
- The promise and status of international applications of photovoltaics
[DE82-006152] p 16 N83-18042
- Data report for the Northeast Residential Experiment Station, October 1981
[DE82-007648] p 61 N83-18044
- Development of a high capacity toroidal Ni/Cd cell [NASA-CR-169945] p 174 N83-19273

PHOTOVOLTAIC EFFECT

- Photoconductivity and photovoltaic effect in indium selenide
p 39 A83-22337
- Design and fabrication of a prototype system for a photovoltaic residence in the Northeast
[DE82-022497] p 55 N83-16871
- Intermediate photovoltaic system application experiment operational performance report Volume 1 G N Wilcox Memorial Hospital, Kauai, Hawaii
[DE83-000393] p 57 N83-16897
- Innovative photovoltaic application for residences experiment
[DE83-000399] p 57 N83-16898
- Penetration and air-emission-reduction benefits of solar technologies in the electric utilities
[DE82-002637] p 9 N83-16971
- Intermediate photovoltaic system application experiment operational performance report Volume 5 for Lovington Square Shopping Center, Lovington, NM
[DE82-006877] p 65 N83-19286
- A microprocessor-controlled photovoltaic-array loading unit
[DE83-000797] p 75 N83-21556
- Intermediate photovoltaic system application experiment operational performance executive summary Volume 7 Lovington Square Shopping Center, Lovington, New Mexico
[DE82-014649] p 76 N83-21566
- Photovoltaic 1.5 curve measurement techniques
[DE83-000447] p 80 N83-22534

PHYSIOCHEMISTRY

- The utilization of emergent aquatic plants for biomass-energy-systems development
[DE82-009174] p 124 N83-20395

PHYSIOLOGICAL EFFECTS

- A physiological and hygienic evaluation of the work regime of operators who are working in current energy production in Kirghizia
p 4 A83-28765

PHYSIOLOGICAL TESTS

- Biostatistics and health impacts of energy technologies p 36 N83-22962
- PHYSIOLOGICAL TESTS**
- Study of psychophysiological distinctions of primates using delayed reaction test p 85 N83-26442
- PILOT PLANTS**
- Design, fabrication, and initial testing of solar one receiver p 47 A83-27229
- Ocean thermal energy at the Johns Hopkins University Applied Physics Laboratory [PB82-257536] p 165 N83-16937
- Results of u-bend stress-corrosion-cracking specimen exposures in coal-liquefaction pilot plants [DE82-012889] p 105 N83-17708
- H-Coal Pilot Plant. Phase 2 Construction and Phase 3 Operation [DE82-005117] p 106 N83-17732
- Solvent-Refined-Coal (SRC) process [DE82-010061] p 107 N83-17743
- EDS coal-liquefaction process development, phase 5 [DE82-012444] p 118 N83-19862
- Liquid-phase methanol process development unit Installation, operation, and support studies [DE82-012725] p 121 N83-19940
- Pipeline gas from coal Hydrogenation (IGT hydrogasification process) [DE82-014611] p 121 N83-19941
- Enlargement of the raw material basis of refineries by including hard coal Pilot plant for coal hydrogenation, construction phase [BMFT-FB-182-192] p 126 N83-21054
- A 10-MWe solar-thermal central-receiver pilot plant. Solar facilities design integration Plant operating/training manual (RADL-Item 2-36) [DE83-001670] p 75 N83-21551
- SRC-I solvent-refined-coal process Operation of the solvent-refined-coal pilot plant, Wilsonville, Alabama [DE82-009931] p 137 N83-22337
- 1980 operation of SRC pilot plant, Wilsonville, Alabama [DE82-008323] p 137 N83-22339
- Coal-liquefaction-plant fractionation-column corrosion-coupon studies [DE82-007469] p 139 N83-22360
- Environmental effects of solar-thermal power systems Ecological observations during early testing of the Barstow 10-MWe pilot STPS [DE83-004454] p 85 N83-22856
- PIPE FLOW**
- The generation of electric currents by the turbulent flow of dielectric liquids I - Long pipes p 161 A83-29089
- Transport characteristics of alternate slurry fuels [DE82-013508] p 121 N83-19939
- PIPELINES**
- Systems analysis of hydrogen supplementation in natural gas pipelines [DE82-006933] p 89 N83-17740
- PIPES (TUBES)**
- Boundary-layer control by means of strong injection [DE82-012547] p 142 N83-22568
- Thermal fatigue tests of Solar One receiver-tube weldments [DE82-012520] p 81 N83-22599
- Energy-transmission-system heat losses [DE83-003628] p 187 N83-22786
- PISTON ENGINES**
- Characteristics of a closed Brayton cycle piston engine p 151 A83-23135
- Design and experiences with a laboratory Stirling cycle machine p 157 A83-27284
- The spark-ignition aircraft piston engine of the future p 141 N83-22450
- PISTONS**
- Design of hydraulic output Stirling engine [NASA-CR-167976] p 181 N83-22739
- PLANNING**
- A review of utility issues for the integration of wind electric generators p 173 N83-19269
- Energy planning for development. Needs and approaches [DE82-014180] p 26 N83-20420
- PLANT DESIGN**
- Stirling engines for solar power generation in the 50 to 500 kW range p 50 A83-27274
- Design, construction, operation and costs of a modern small-scale fuel-alcohol plant [DE82-011019] p 107 N83-17754
- Status of the Great Plains Coal Gasification Project, August 1982 [GAO/EMD-82-117] p 115 N83-19230
- Enlargement of the raw material basis of refineries by including hard coal Pilot plant for coal hydrogenation, construction phase [BMFT-FB-182-192] p 126 N83-21054

PLASMA CONDUCTIVITY

- Measurement of plasma conductivity using Faraday rotation of submillimeter waves p 151 A83-23139
- Discharges in the inlet region of a noble gas MHD generator --- Thesis p 161 A83-28643
- PLASMA CONTROL**
- The stellarator approach to toroidal plasma confinement [DE82-005727] p 165 N83-17325
- Fiscal year 1983 Department of Energy budget review Magnetic fusion energy Volume 5 [GPO-98-550] p 175 N83-20372
- PLASMA DYNAMICS**
- The plasmadynamics and ionization kinetics of thermionic energy conversion [DE82-012938] p 176 N83-20421
- PLASMA ELECTRODES**
- MHD channel electrical boundary-layer theory and applications p 151 A83-23131
- PLASMA GENERATORS**
- Fusion technology status and requirements [DE82-010754] p 174 N83-19615
- High power pulsed plasma MHD experiments [AD-A120526] p 176 N83-20782
- PLASMA INTERACTIONS**
- Distribution voltage for high-power satellites p 153 A83-27150
- PLASMA JETS**
- Discharges in the inlet region of a noble gas MHD generator --- Thesis p 161 A83-28643
- PLASMA PHYSICS**
- Physics of mirror systems [DE82-015908] p 176 N83-20770
- PLASMONS**
- A new strategy for efficient solar energy conversion - Parallel-processing with surface plasmons p 46 A83-27140
- PLASTIC DEFORMATION**
- Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures [AD-A113883] p 72 N83-20802
- Stress studies in EFG [NASA-CR-170205] p 81 N83-22745
- PLASTIC PROPERTIES**
- Solar energy systems Standards for screening plastic containment materials [PB82-242454] p 62 N83-18921
- PLASTICS**
- Solar energy systems Standards for screening plastic containment materials [PB82-242454] p 62 N83-18921
- Photovoltaic concentrator with plastic-film reflector [DE83-001715] p 75 N83-21547
- PLYWOOD**
- Simulation of air-pollution propagation resulting from at-sea incineration wastes [DE82-902297] p 10 N83-16979
- Vertical sampling flights in support of the 1981 ASCOT cooling tower experiments Field effort and data [DE82-014269] p 135 N83-21661
- PLUTONIUM**
- The Light Weight Radioisotope Heater Unit (LWRHU) A technical description of the reference design [DE82-014121] p 148 N83-23138
- Reentry thermal testing of a general purpose heat source fueled clad [DE82-014125] p 184 N83-23146
- Reentry thermal testing of light-weight radioisotope heater unit [DE82-014116] p 148 N83-23147
- PLYWOOD**
- Design of plywood and paper flywheel rotors [DE83-002276] p 195 N83-20430
- POLLUTION CONTROL**
- Design strategy for the combustion of coal-derived liquid fuels [DE82-905496] p 95 N83-16444
- Penetration for four solar technologies in electric utilities and the environmental benefits [DE82-010864] p 59 N83-16927
- EDS coal-liquefaction process development. Phase 5 EDS environmental program [DE82-005641] p 12 N83-17673
- Testing of heat exchanger systems for reheating flue gases from wet scrubbing desulfurization plants [BMFT-FB-T-82-170] p 13 N83-17841
- Rationale for advances in the technology of I C engines [DE82-000264] p 14 N83-17886
- A rationale for advances in the technology of I C engines [DE82-005840] p 14 N83-17889
- Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States [DE82-011237] p 18 N83-18108

SUBJECT INDEX

- State-of-the-art combustion modification NOx control for stationary combustion equipment [PB82-240201] p 23 N83-19340
- Costs to reduce sulfur dioxide emissions [DE82-013309] p 28 N83-20451
- Acid rain mitigation study Volume 1 FGD cost estimates [PB83-101329] p 29 N83-20459
- Acid rain mitigation study Volume 2 FGD cost estimates, appendices [PB83-117366] p 29 N83-20469
- Acid precipitation A critique of present knowledge and proposed action [DE83-900303] p 34 N83-21650
- POLLUTION MONITORING**
- Environmental radiation surveillance program [DE82-902009] p 19 N83-18116
- POLLUTION TRANSPORT**
- The influence of large-scale advection on the vertical distribution of stratospheric source gases in 44 degree and 41 degree north p 1 A83-20224
- Simulation of air-pollution propagation resulting from at-sea incineration wastes [DE82-902297] p 10 N83-16979
- POLYCRYSTALS**
- Practical limiting efficiencies for crystalline silicon solar cells p 37 A83-19893
- Effect of grain boundaries on the minority carrier diffusion length in InP solar cells p 40 A83-22908
- Grain boundary effects in polycrystalline silicon solar cells I - Solution of the three-dimensional diffusion equation by the Green's function method II - Numerical calculation of the limiting parameters and maximum efficiency p 52 A83-27981
- Optimization of piling conditions by electronic bombardment of polycrystalline silicon ribbons for solar cells --- French thesis p 55 A83-29946
- Polycrystalline solar cell/substrate growth by integrated vacuum evaporation [DE82-017203] p 58 N83-16917
- Effects of grain boundaries in GaAs solar cells [DE82-006118] p 61 N83-18059
- Photovoltaic cell and module status assessment Volume 1 Technology overview [DE83-900567] p 82 N83-22791
- POLYMER CHEMISTRY**
- Degradation and characterization of antimisting kerosene (AMK) [MED-132] p 120 N83-19922
- POLYMERIC FILMS**
- Cross-linked polyvinyl alcohol films as alkaline battery separators p 149 A83-20576
- Evaluation of solar reflective surfaces for dish concentrators p 48 A83-27237
- Flat-plate solar collectors utilizing polymenc film for high performance and very low cost [DE82-004797] p 56 N83-16877
- Semiconducting polyacetylene materials for energy-conversion applications [DE82-012320] p 70 N83-20407
- Low-cost, high-performance solar flat-plate collectors for applications in northern latitudes [DE82-010626] p 71 N83-20428
- Development of polymer film solar collectors A status report [DE83-005995] p 80 N83-21643
- POLYMERS**
- Status of solid polymer electrolyte fuel cell technology and potential for transportation applications p 154 A83-27186
- Stability of reflectors with polymenc coatings [DE82-007774] p 60 N83-17723
- Coalinga polymer demonstration project [DE82-007019] p 105 N83-17726
- The electrochemical fluorination of polymenc materials for high energy density aqueous and non-aqueous battery and fuel cell separators [NASA-CR-167961] p 177 N83-21056
- POLYPROPYLENE**
- Evaluation of production version of the NASA improved inorganic-organic separator [NASA-TM-83018] p 166 N83-18022
- POLYVINYL ALCOHOL**
- Cross-linked polyvinyl alcohol films as alkaline battery separators p 149 A83-20576
- POROSITY**
- Pore size engineering applied to starved electrochemical cells and batteries p 154 A83-27201
- Catalytic evaluation for H-coal [DE82-014457] p 138 N83-22355
- POROUS MATERIALS**
- Simple porous electrode models for molten carbonate fuel cells p 149 A83-19891
- Porous perovskite electrode as molten carbonate cathode --- in fuel cells p 150 A83-20596

- Porous metal hydride compacts - Preparation, properties and use p 88 A83-27338
 Mass transfer and chemical reaction of gaseous species in non-catalytic and catalytic porous media supporting catalytic and non-catalytic liquids [DE82-021713] p 95 N83-16427
 Multiple-tracer gas analyzer [DE82-017032] p 120 N83-19876
- PORTABLE EQUIPMENT**
 An improved portable thermoradiometer /TRM/ for measuring the relative emissivity of solids at room temperature p 39 A83-20959
 Fuel cell electrolyte for portable electrical generating equipment [AD-A121176] p 174 N83-19275
- POSITION (LOCATION)**
 Mine personnel locator and mine activity controller [PB82-235979] p 200 N83-19315
 The importance of satisfactory positioning, diving and mapping systems suitable for exploration and transportation in icecovered sea areas [PB83-109587] p 123 N83-20342
- POSITIVE FEEDBACK**
 Feedback mechanisms in the climate system affecting future levels of carbon dioxide p 2 A83-24252
- POTASSIUM CHLORIDES**
 Catalytic coal gasification - An emerging technology for SNG [DE82-007596] p 104 N83-17676
- POTASSIUM COMPOUNDS**
 Vaporization thermodynamics of K₂S and K₂SO₃ [NASA-CR-168080] p 117 N83-19812
- POTENTIAL FLOW**
 Steam generation in line-focus solar collectors - A comparative assessment of thermal performance, operating stability and cost issues [DE82-014531] p 76 N83-21568
- POWER CONDITIONING**
 Solar array switching power management p 45 A83-27132
 Photovoltaic array Power conditioner interface characteristics [NASA-CR-169919] p 64 N83-19225
 Photovoltaic subsystem optimization and design tradeoff study [DE82-013393] p 69 N83-20392
 Fourth ESTEC spacecraft power-conditioning seminar [ESA-SP-186] p 176 N83-21006
- POWER CONVERTERS**
 Application of microprocessor-based controls in an ac/dc power conversion system p 188 A83-27151
- POWER EFFICIENCY**
 An optimization of monolithic photovoltaic series arrays p 38 A83-20751
 Cross-sectional current distribution in coal fired diagonal conducting wall MHD generator p 151 A83-23130
 Characteristics of a closed Brayton cycle piston engine p 151 A83-23135
 A system of criteria for evaluating the energy efficiency of an engine at the state of technical proposals p 1 A83-23437
 Comparison of evolving photovoltaic and nuclear power systems for earth orbital applications p 45 A83-27131
 Energy utilization of electric and hybrid vehicles p 188 A83-27164
 Performance characteristics of wet and dry fluidynes --- Stirling cycle engines p 156 A83-27276
 Improved Stirling engine performance using jet impingement p 158 A83-27288
 Effects of displacer seal clearance on free-piston Stirling engine performance p 158 A83-27295
 The fill factor of a solar cell from a mathematical point of view p 52 A83-27986
 The loss of power supply probability as a technique for designing stand-alone solar electrical (photovoltaic) systems p 54 A83-29896
 A rationale for advances in the technology of I C engines [DE82-005840] p 14 N83-17889
 Route profile analysis to determine suitability of electric postal-delivery vehicles [DE82-012216] p 29 N83-20842
 Study of solar array switching power management technology for space power system [NASA-CR-167890] p 81 N83-22756
- POWER FACTOR CONTROLLERS**
 Power factor controllers p 80 N83-22510
- POWER GAIN**
 Augmentation of power in slow-running vertical-axis wind rotors using multiple vanes p 160 A83-27868
- POWER LINES**
 Metallurgical aspects of interstrand resistance --- superconducting magnets [DE82-005504] p 186 N83-17342
 Power factor controllers p 80 N83-22510
- Materials research for hydrogen-cooled Superconducting Power-Transmission Lines (SPTL) Part 1 Liquid hydrogen as a dielectric Part 2 Superconducting materials [DE83-004801] p 187 N83-22529
- POWER MODULES (STS)**
 Reentry thermal testing of a general purpose heat source fueled clad [DE82-014125] p 184 N83-23146
- POWER PLANTS**
 On-site fuel cell power plant technology development program [PB83-102335] p 176 N83-20437
 Real time sensors in geothermal fluids, their costs and benefits [DE82-014857] p 130 N83-21328
 Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model [DE83-004004] p 197 N83-22758
- POWER SUPPLIES**
 Stochastic methods for analysis of power flow in electric networks [DE83-000445] p 5 N83-16653
 Research needs Prime-power for high energy space systems [AD-A120209] p 163 N83-16861
 Research on spacecraft electrical power conversion [NASA-CR-169974] p 20 N83-19227
 Demonstration of a solar/wind-powered electrostatic-field food-keeping device [DE82-007971] p 65 N83-19285
 Intermediate photovoltaic system application experiment operational performance executive summary Volume 7 Lovington Square Shopping Center, Lovington, New Mexico [DE82-014649] p 76 N83-21566
 Photovoltaic 1-5 curve measurement techniques [DE83-000447] p 80 N83-22534
- POWER SUPPLY CIRCUITS**
 Solar array switching power management p 45 A83-27132
 High-efficiency spacecraft power conversion techniques p 45 A83-27135
 Solar array power management --- in spacecraft power supplies p 46 A83-27148
 The use of mechanical energy storage in an unconventional, rough terrain vehicle p 190 A83-27309
 Design study of a high power rotary transformer [NASA-CR-168012] p 186 N83-16630
- PRECIPITATION (CHEMISTRY)**
 Physical chemistry of molten-salt batteries Current-induced composition gradients in molten LiCl-KCl [DE83-001684] p 192 N83-16875
- PRECISION**
 Preliminary analysis of the state of the art of robotics and precision engineering and evaluation of potential for improved energy utilization in the pulp, paper, and related energy-consuming processes [DE83-001016] p 21 N83-19294
- PREDICTION ANALYSIS TECHNIQUES**
 A data-gathering method for use in modeling energy research, development and demonstration programs [DE82-006153] p 16 N83-18040
 Heavy Gas Dispersal [VKI-LS-1982-03] p 200 N83-19316
 Modeling water supply for the energy sector p 25 N83-20336
 World oil [DE82-906440] p 27 N83-20433
- PREDICTIONS**
 Uncertainties of predictions of future atmospheric CO₂ concentrations p 2 A83-24251
 Feedback mechanisms in the climate system affecting future levels of carbon dioxide p 2 A83-24252
 Exponential growth and atmospheric carbon dioxide p 2 A83-24255
 Two global scenarios The evolution of energy use and the economy to 2030 [IIASA-RR-81-35] p 14 N83-18021
 Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 2 User's manual for a computer program for 1-dimensional coal combustion or gasification (1-DICOG) [DE82-015610] p 119 N83-19868
 Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 3 User's manual for a computer program for 2-Dimensional Coal Gasification or Combustion (PCGC-2) [DE82-015611] p 119 N83-19869
 Coal p 143 N83-22675
 Uranium p 143 N83-22677
- US energy for the rest of the century [PB83-114603] p 36 N83-22838
- PREMIXED FLAMES**
 Effect of molecular structure on incipient soot formation p 90 A83-19847
 The origin and nature of 'prompt' nitric oxide in flames p 1 A83-22344
 Premixed, turbulent combustion of a sudden-expansion flow p 92 A83-23748
- PRESSING (FORMING)**
 Compression molded energy storage flywheels p 189 A83-27303
- PRESSURE DEPENDENCE**
 Catalytic hydrogenation of coal-derived liquids [DE83-003582] p 126 N83-21068
- PRESSURE EFFECTS**
 Effect of argon pressure on the optical properties of sputtered solar selective surfaces p 40 A83-22620
- PRESSURE RATIO**
 18.1 pressure ratio axial/centrifugal compressor demonstration program p 161 A83-29013
- PRESSURE SENSORS**
 Slideslip indication system p 12 N83-17466
- PRESSURE VESSELS**
 Operational experiences of a downhole steam generator [DE82-010161] p 100 N83-16906
 Some 2 1/4Cr-1 Mo steels for coal-conversion pressure vessels [DE82-901349] p 105 N83-17707
 Low-alloy steels for thick-walled pressure vessels [DE83-002547] p 128 N83-21127
 Catalytic coal conversion support. Use of laser flash-pyrolysis for structural analysis [DE82-014124] p 139 N83-22366
- PRIMARY BATTERIES**
 A zinc paste primary battery --- for electric vehicles p 153 A83-26052
 Energy generating and storing method for space application p 177 N83-21021
- PRINTED CIRCUITS**
 Screen printed interdigitated back contact solar cell [NASA-CASE-LEW-13414-1] p 68 N83-20374
- PRIORITIES**
 New priorities in energy-conservation research and development [DE82-005988] p 16 N83-18054
- PROBABILITY DENSITY FUNCTIONS**
 A probability density function for the clearness index, with applications p 53 A83-28938
- PROCEEDINGS**
 Large Horizontal-Axis Wind Turbines [NASA-CP-2230] p 169 N83-19231
- PROCESS CONTROL (INDUSTRY)**
 Process engineering and mechanical design reports Volume 1 Preliminary design and assessment of a 50,000 BPD coal-to-methanol-to-gasoline plant [DE83-000848] p 97 N83-16559
 Advanced research and technology development fossil energy materials program [DE82-007121] p 111 N83-18085
 ASPEN technical reference manual [DE82-020200] p 112 N83-18326
 ASPEN system administrator manual [DE82-202199] p 112 N83-18327
 ASPEN system administrator manual [DE82-020198] p 113 N83-18328
 ASPEN user manual [DE82-020196] p 113 N83-18329
 Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 2 User's manual for a computer program for 1-dimensional coal combustion or gasification (1-DICOG) [DE82-015610] p 119 N83-19868
 Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 3 User's manual for a computer program for 2-Dimensional Coal Gasification or Combustion (PCGC-2) [DE82-015611] p 119 N83-19869
 Effect of liquefaction processing conditions on combustion characteristics of solvent-refined coal [DE82-903665] p 139 N83-22361
- PROCESS HEAT**
 Cogeneration using a thermionic combustor p 159 A83-27300

PRODUCT DEVELOPMENT

- Evaluation of industrial advanced heat recovery/thermal energy storage systems
[DE82-906475] p 193 N83-16919
- Status report on sulfur iodine thermochemical water-splitting cycle
[DE82-007164] p 88 N83-17633
- The 5 MW for solar-chemistry development
[DE82-002064] p 60 N83-18043
- Thermal system engineering experiment
[NASA-CR-169901] p 63 N83-19215
- Solar-energy treatment of ceramic tiles
[DE83-000147] p 65 N83-19296
- Solar for industry
[DE83-003301] p 68 N83-20381

PRODUCT DEVELOPMENT

- Sasol The commercial experience An executive summary
[DE82-011304] p 98 N83-16572
- Solvent-Refined-Coal (SRC) process
[DE82-010061] p 107 N83-17743
- The promise and status of international applications of photovoltaics
[DE82-006152] p 16 N83-18042
- Fiberglass composite blades for the 2 MW Mod-1 wind turbine generator
[DE82-016756] p 170 N83-19241
- EDS coal-liquefaction process development Phase 5
[DE83-002226] p 117 N83-19827
- Graded-index antireflective coatings for glass
[DE82-016756] p 67 N83-19917
- Low-cost, high-performance solar flat-plate collectors for applications in northern latitudes
[DE82-010626] p 71 N83-20428
- Design and development of monolithic acrylic Fresnel lenses for use in point-focus PV systems
[DE82-00554] p 72 N83-20768
- Program for predicting thermal performance based on test data of low- to medium-temperature line-focusing, concentrating solar collectors
[DE82-012605] p 82 N83-22776
- Coordination of the onsite fuel cell program
[PB83-119545] p 184 N83-22839

PRODUCTION COSTS

- Solar technology - A whether report
[DE82-010502] p 43 A83-25124
- Study to establish cost predictions for the production of Redox chemicals
[NASA-CR-167882] p 194 N83-20359

PRODUCTION ENGINEERING

- Manufacture and testing of fibre composite rotor components /Fibre composite flywheel development program for road vehicle applications/
[DE82-010502] p 190 A83-27308
- Advanced coal preparation
[DE82-010502] p 97 N83-16561
- Evaluation of the mathematical and economic basis for conversion processes in the LEAP energy-economy model
[DE83-001706] p 167 N83-18079
- Recovery of gas from hydrate deposits using conventional production technology
[DE82-008106] p 145 N83-22775

PRODUCTION PLANNING

- Sasol The commercial experience An executive summary
[DE82-011304] p 98 N83-16572
- Evaluation of the mathematical and economic basis for conversion processes in the LEAP energy-economy model
[DE83-001706] p 167 N83-18079

PRODUCTIVITY

- Effects of petroleum on selected uniform substrates
A feasibility study
[PB82-255084] p 10 N83-16985
- Energy-efficient technology Advancing US competitiveness and productivity
[GPO-98-637] p 25 N83-20371

PROJECT MANAGEMENT

- Modeling energy/economy interactions for conservation and renewable energy-policy analysis
[DE82-009159] p 7 N83-16926
- The comprehensive community energy management program An evaluation
[DE82-011552] p 17 N83-18060
- Program planning for future improvement in managing ORNL's radioactive wastes
[DE82-007721] p 19 N83-18467
- Program management plan for the conduct of a research, development and demonstration program for improving the safety of nuclear powerplants
[DE82-008776] p 19 N83-18555
- Status of the Great Plains Coal Gasification Project, August 1982
[GAO/EMD-82-117] p 115 N83-19230
- Activities report in space research in the Federal Republic of Germany
[AD-A120526] p 200 N83-19702

- Status of the Great Plains coal gasification project, August 1982
[PB83-115139] p 130 N83-21188
- Passive-Solar Commercial Buildings Program, 1980 - 1982
[DE82-012472] p 72 N83-21202
- The Alternative Fuels for Medium Speed Diesel Engines (AFFMSDE) project A baseline program planning concept for review and revision
[DE82-002565] p 141 N83-22461
- Coordination of the onsite fuel cell program
[PB83-119545] p 184 N83-22839
- PROJECT PLANNING**
Fossil energy materials program plan for fiscal years 1982 through 1986
[DE83-004237] p 131 N83-21519

PROPANE

- Organic rankine cycle coupled to a solar pond by direct-contact heat exchange - selection of a working fluid
[DE82-020998] p 57 N83-16900
- Flame acceleration mechanisms under conditions of partial confinement
[PB83-109884] p 120 N83-19881
- Safe handling and testing of alternative fuels
[DE82-009176] p 89 N83-21183

PROPELLANT DECOMPOSITION

- Degradation and characterization of antimisting kerosene
[DE82-016756] p 92 A83-24035

PROPELLANT PROPERTIES

- Degradation and characterization of antimisting kerosene
[DE82-016756] p 92 A83-24035

PROPULSION SYSTEM CONFIGURATIONS

- The spark-ignition aircraft piston engine of the future
[DE82-009176] p 141 N83-22450

PROPULSION SYSTEM PERFORMANCE

- Implementation of R & QA practices in Research and Development programs
[NASA-TM-82997] p 24 N83-19651

PROPULSIVE EFFICIENCY

- The MCA method, a flight test technique to determine the thrust of jet aircraft in flight --- Mass Consumption Acceleration
[NASA-TM-83036] p 1 A83-19661
- Tests of an alternating current propulsion subsystem for electric vehicles on a road load simulator
[NASA-TM-83036] p 182 N83-22749

PROPYL COMPOUNDS

- Propanol-plus as extender to diesel fuel
[CSIR-ME-445] p 128 N83-21165

PROTECTIVE COATINGS

- High temperature erosion and erosion-hot corrosion of superalloys and coatings
[PB82-258757] p 91 A83-21458
- Coating applications for the molten carbonate fuel cell
[PB82-258757] p 153 A83-25538
- Bipolar lead accumulator cell with high energy density
[DE82-007774] p 193 N83-16934
- Stability of reflectors with polymenc coatings
[DE82-007774] p 60 N83-17723

PSYCHOPHYSIOLOGY

- A physiological and hygienic evaluation of the work regime of operators who are working in current energy production in Kirghizia
[DE82-007774] p 4 A83-28765

PUBLIC HEALTH

- Health and safety issues of alternate energy systems
[DE82-002918] p 9 N83-16959
- Environmetrics of synfuels Part 4 Project Results Tracking System (PRTS)
[DE82-011444] p 10 N83-16977
- Western oil shale development A technology assessment Volume 8 Health effects of oil shale development
[DE82-008695] p 109 N83-18015
- Environmental impacts of undergrounding high-voltage transmission Health and safety
[DE82-010108] p 186 N83-18102
- Estimating pollutant exposures from coal fired power plants in a rural region
[DE82-008136] p 19 N83-18109
- Engineering the Future for the Benefit of Mankind, volume 2
[PB82-225491] p 24 N83-19634

PUBLIC LAW

- The acquisition of wind rights for wind energy development
[DE82-009139] p 32 N83-21597

PULLING

- Optimization of pulling conditions by electronic bombardment of polycrystalline silicon ribbons for solar cells --- French thesis
[DE82-005698] p 55 A83-29946

PULSE GENERATORS

- Coatings for laser fusion
[DE82-005698] p 165 N83-17330
- High power pulsed plasma MHD experiments
[AD-A120526] p 176 N83-20782

PUMPS

- Status of DOE small hydropower research and development projects
[DE83-001353] p 125 N83-20434
- Solar-energy-system performance evaluation
Honeywell OTS 44, Ocmulgee, Georgia
[NASA-CR-170031] p 74 N83-21530
- Irrigation pumping using geothermal energy
[DE83-005308] p 135 N83-21641

PURIFICATION

- Clean-up and processing of coal-derived gas for hydrogen applications
[DE82-010417] p 87 A83-27336
- Liquefaction behavior of a Canadian subbituminous coal in comparison with several US lignites and subbituminous coals
[DE82-021976] p 146 N83-22824

PURITY

- Radioisotopes for heat-source applications
[DE83-005045] p 137 N83-21934

PYRANOMETERS

- On insolation measurements using pyranometers and solar cell devices
[DE82-012369] p 104 N83-17657

PYRITES

- Relationship between pyrite formation and organic sulfur content of coal as revealed by electron microscopy
[DE82-010417] p 104 N83-17652
- Solvent-Refined-Coal (SRC) Process Coking of SRC-2 process streams Part 3 Effects of coal minerals on coking Part 4 Thermal properties of SRC-2 cokes and process streams
[DE82-012369] p 104 N83-17657
- Desulfurisation of solid fuels in power stations by superconductive magnets
[BLL-CE-TRANS-7855-(9022 09)] p 125 N83-21051

PYROLYSIS

- Rates and equilibria of devolatilization and trace element evolution in coal pyrolysis
[PB82-260944] p 96 N83-16460
- The 5 MW for solar-chemistry development
[DE82-002064] p 60 N83-18043
- Entrained flow, ablative fast pyrolysis of biomass
[DE82-005791] p 113 N83-18875
- Coal pyrolysis by hot solids from a fluidized-bed combustor
[DE83-003344] p 117 N83-19829
- Low-temperature pyrolysis of coal to produce diesel-fuel blends
[DE83-001637] p 126 N83-21076
- Flash pyrolysis of biomass with reactive and non-reactive gases
[DE83-001850] p 137 N83-22336
- Status of the cadmium thermoelectrochemical hydrogen cycle
[DE83-900088] p 89 N83-22349
- Catalytic coal conversion support Use of laser flash-pyrolysis for structural analysis
[DE82-014124] p 139 N83-22366
- PYRRHOTITE**
Solvent-Refined-Coal (SRC) Process Coking of SRC-2 process streams Part 3 Effects of coal minerals on coking Part 4 Thermal properties of SRC-2 cokes and process streams
[DE82-012369] p 104 N83-17657

Q

QUALITY

- EDS coal-liquefaction process development Phase 5
[DE83-002226] p 117 N83-19827

QUANTUM EFFICIENCY

- Design of antireflection coatings for textured silicon solar cells
[DE82-021243] p 52 A83-27983
- Chalcogenide-glass solar cells
[DE82-021243] p 68 N83-20382

QUASI-STEADY STATES

- Performance simulation of the JPL solar-powered distiller Part 1 Quasi-steady-state conditions --- for cooling microwave equipment
[DE82-012369] p 66 N83-19781

R

RADIAL VELOCITY

- Joint measurements of radial velocity and scalars in a turbulent diffusion flame
[DE82-009139] p 32 N83-21597

RADIANT COOLING

- Thermal control - Heat buses will operate like a public utility
[DE82-008776] p 19 N83-18555
- Long titanium heat pipes for high-temperature space radiators
[DE82-008776] p 19 N83-18555

RADIATION ABSORPTION

- Heat loss coefficients and effective tau-alpha products for flat-plate collectors with diathermanous covers
[DE82-008776] p 19 N83-18555

SUBJECT INDEX

RADIATION DAMAGE

Space applications of gallium arsenide solar cells
p 50 A83-27258

RADIATION EFFECTS

Electric power from orbit. A critique of a satellite power system
[DE83-002771] p 33 N83-21619
Pressing problems of radioecology in light of solving atomic energy problems p 36 N83-22977

RADIATION HAZARDS

Is nuclear energy an unacceptable hazard to health?
[DE82-004954] p 9 N83-16961
Proceedings of the Workshop on Radioactivity Associated with Coal Gas
[DE82-007880] p 18 N83-18100
Program planning for future improvement in managing ORNL's radioactive wastes
[DE82-007721] p 19 N83-18467

RADIATION MEASUREMENT

Environmental radiation surveillance program
[DE82-902009] p 19 N83-18116

RADIATION SPECTRA

Terrestrial solar spectral data sets
[DE83-000504] p 60 N83-17001

RADIATIVE HEAT TRANSFER

Heat loss coefficients and effective tau-alpha products for flat-plate collectors with diathermanous covers
p 53 A83-28939

RADIOACTIVE ISOTOPES

Radioisotopes for heat-source applications
[DE83-005045] p 137 N83-21934
Pressing problems of radioecology in light of solving atomic energy problems p 36 N83-22977

RADIOACTIVE WASTES

A preliminary study of environmental parameters associated with the feasibility of a polygeneration plant at Kennedy Space Center p 11 N83-17365
A brief overview of geophysical probing technology
[DE82-011217] p 19 N83-18133
Program planning for future improvement in managing ORNL's radioactive wastes
[DE82-007721] p 19 N83-18467

Feasibility of applications of microwave technology for nuclear power plant radioactive wastes
[DE82-903143] p 29 N83-20744
Radioisotopes for heat-source applications
[DE83-005045] p 137 N83-21934

RADIOACTIVITY

Utilization of the catalyzed-DD fuel cycle in Reversed-Field Pinch Reactors (RFPRs)
[DE82-010425] p 168 N83-18512

RADIOBIOLOGY

Pressing problems of radioecology in light of solving atomic energy problems p 36 N83-22977

RADIOMETERS

An improved portable thermoradiometer /TRM/ for measuring the relative emissivity of solids at room temperature p 39 A83-20959

RADON

Radon-daughter exposures in energy-efficient buildings
[DE82-003711] p 9 N83-16964

RAIL TRANSPORTATION

A systems analysis comparing conventional and hydrogen powered rail locomotives p 87 A83-27213
Transportation network models for energy supply analysis. Volume 1. Executive summary
[DE82-903077] p 187 N83-20399
The Alternative Fuels for Medium Speed Diesel Engines (AFFMSDE) project. A baseline program planning concept for review and revision
[DE83-002565] p 141 N83-22461

RAMAN SPECTRA

Laser-plasma interaction experiments at laser wavelengths of 1 064 micron, 0 532 micron and 0 355 micron
[DE82-013992] p 175 N83-20114

RAMJET ENGINES

Investigation of slurry fuel performance for use in a ramjet propulsor p 90 A83-21014

RANKINE CYCLE

Stored chemical energy propulsion system for underwater applications
[AIAA PAPER 81-1601] p 188 A83-23132
Twenty years of experience with organic Rankine cycle turbines - Their applicability and use in energy conservation and alternative energy systems p 3 A83-27207
Organic rankine cycle coupled to a solar pond by direct-contact heat exchange - selection of a working fluid
[DE82-020998] p 57 N83-16900
Rankine/Rankine cycle gas-fired heat pump
[PB82-254640] p 165 N83-16944
Applications guide for waste heat recovery
[NASA-CR-170121] p 178 N83-21511

Solar-energy-system performance evaluation
Honeywell OTS 44, Ocmulgee, Georgia
[NASA-CR-170031] p 74 N83-21530

Design and component testing of a low-temperature waste-heat-driven refrigeration system, phases 1 and 2
[DE82-014721] p 179 N83-21571

Engineering development studies for integrated evacuated CPC arrays
[DE82-013941] p 77 N83-21583

The variable pressure supercritical Rankine cycle for integrated natural gas and power production from the geopressured geothermal resource
[DE82-008957] p 179 N83-21591

RAPID TRANSIT SYSTEMS

An advanced electric vehicle powertrain
p 154 A83-27161

RARE GASES

Discharges in the inlet region of a noble gas MHD generator --- Thesis p 161 A83-28643

RATINGS

Wisconsin collector-efficiency study, phase two
[DE82-013425] p 71 N83-20426

REACTION KINETICS

The structure of the double layer at the mercury-phosphoric acid interface from studies of adsorption of thiourea and its implications on oxygen reduction kinetics --- in fuel cells p 149 A83-19876
A mechanistic study of oxygen evolution on Li-doped Co₃O₄ --- by electrolysis p 85 A83-20586
The origin and nature of 'prompt' nitric oxide in flames p 1 A83-22344

The kinetics and mechanism of the reaction of ozone with sulphides
[BLL-CA-TRANS-1934-(6196 3)] p 94 N83-16411

Mass transfer and chemical reaction of gaseous species in non-catalytic and catalytic porous media supporting catalytic and non-catalytic liquids
[DE82-021713] p 95 N83-16427

Rates and equilibria of devolatilization and trace element evolution in coal pyrolysis
[PB82-260944] p 96 N83-16460

Mechanisms and kinetics of coal hydrogenation
[DE82-012338] p 105 N83-17677

Electromigrational composition gradients in molten carbonates. A review
[DE83-002593] p 177 N83-21075

Study of net soot formation in hydrocarbon reforming for hydrogen fuel cells
[DE83-001046] p 90 N83-22352

Exploratory study of coal conversion chemistry
[DE82-013414] p 138 N83-22354

REACTOR CORES

Artery heat pipes for space power systems
p 185 A83-27128

REACTOR DESIGN

Artery heat pipes for space power systems
p 185 A83-27128

Direct conversion nuclear reactor space power systems p 158 A83-27296

Direct-energy-conversion implications of space nuclear reactors p 159 A83-27297

Thermionic technology infrastructure for space power p 159 A83-27298

REACTOR SAFETY

Overview of fusion reactor safety p 166 N83-17331

Tritium transport and control in the FED
[DE82-002592] p 168 N83-18511

Program management plan for the conduct of a research, development and demonstration program for improving the safety of nuclear powerplants
[DE82-008776] p 19 N83-18555

REACTOR TECHNOLOGY

Fusion technology status and requirements
[DE82-010754] p 174 N83-19615

REAL TIME OPERATION

An on-board near-optimal climb-dash energy management
[NASA-CR-169755] p 4 N83-16329

RECEIVERS

Receiver subsystem analysis report (RADL Item 4-1)
The 10-MWe solar thermal central-receiver pilot plant
Solar-facilities design integration
[DE83-001638] p 65 N83-19295

RECLAMATION

Waste lubricating oil. An annotated review, 1982 revision
[DE83-001439] p 30 N83-21156

Future landscapes of the Colorado plateau. Impacts of energy development
[DE83-900473] p 34 N83-21666

RECOMBINATION REACTIONS

Flash photoelectrochemical studies of transient electrode processes important in solar-energy conversion
[DE83-003134] p 76 N83-21560

REGENERATIVE FUEL CELLS

RECONNAISSANCE

Two level multi-objective reconnaissance system study of a large water resource system
[PB82-239716] p 20 N83-19213

RECOVERABILITY

Potential for domestic heat recovery
[DE82-901395] p 15 N83-18037

Opportunities for direct-contact waste heat recuperators for industrial heat recovery
[DE82-006280] p 15 N83-18038

RECOVERY

Methane from landfills. Preliminary assessment workbook
[DE83-002319] p 111 N83-18075

RECTENNAS

On the choice of the optimal density of vibrators for a rectenna p 184 A83-23464

REDOX CELLS

Design flexibility of redox flow systems --- for energy storage applications p 189 A83-27177

Redox ion flow cell for solar energy storage p 54 A83-29407

Study to establish cost predictions for the production of Redox chemicals
[NASA-CR-167882] p 194 N83-20359

REDUCTION (CHEMISTRY)

The structure of the double layer at the mercury-phosphoric acid interface from studies of adsorption of thiourea and its implications on oxygen reduction kinetics --- in fuel cells p 149 A83-19876

Experimental techniques for the study of photosynthetic water splitting
[DE82-003974] p 89 N83-17668

Liquefaction behavior of a Canadian subbituminous coal in comparison with several US lignites and subbituminous coals
[DE82-021976] p 146 N83-22824

REEFS

Coal-waste artificial-reef program, phase 3. Volume 2. Comprehensive report
[DE82-005591] p 8 N83-16954

REFINING

Evaluation of the maintenance effect on fugitive emissions from refineries in the south coast air quality management district p 23 N83-19356

Catalytic hydrogenation of coal-derived liquids
[DE83-003582] p 126 N83-21068

Motor-fuels for road vehicles
[REPT-24] p 140 N83-22440

Oil and gas p 34 N83-22674

Fuel quality/processing study. Volume 3. Fuel upgrading studies
[NASA-CR-165326-VOL-3] p 144 N83-22754

REFLECTANCE

Chemically vapor-deposited black molybdenum films of high IR reflectance and significant solar absorptance p 44 A83-25534

REFLECTION

Coatings for laser fusion
[DE82-005698] p 165 N83-17330

REFLECTORS

Photovoltaic concentrator with plastic-film reflector
[DE83-001715] p 75 N83-21547

Advanced photovoltaic-trough development
[DE82-015646] p 77 N83-21584

REFRACTION

Subsea permafrost in Harrison Bay, Alaska. An interpretation from seismic data
[AD-A121020] p 125 N83-20479

REFRACTIVITY

Effect of argon pressure on the optical properties of sputtered solar selective surfaces p 40 A83-22620

REFRIGERANTS

Sperly low-temperature geothermal conversion system. Volume 1. Organic-working-fluid properties
[DE82-018529] p 163 N83-16867

Identification of problem areas related to the dispersion of heavy gases p 200 N83-19318

REFRIGERATING MACHINERY

The effect of parasitic refrigeration on the efficiency of magnetic liquefiers p 155 A83-27212

Research, development and demonstration of an advanced actuated heat pump
[PB82-254590] p 164 N83-16932

Design and component testing of a low-temperature waste-heat-driven refrigeration system, phases 1 and 2
[DE82-014721] p 179 N83-21571

REFRIGERATORS

Heating of domestic water by waste heat recovery from household refrigerating equipment
[BMFT-FB-T-82-156] p 7 N83-16930

REGENERATIVE FUEL CELLS

Study to establish cost predictions for the production of Redox chemicals
[NASA-CR-167882] p 194 N83-20359

REGENERATORS

REGENERATORS

A way to relax the dimensional tolerance requirements of clearance regenerators --- in small Stirling engine design p 158 A83-27286

REGULATIONS

The implications of a stochastic approach to air-quality regulations [DE82-001636] p 9 N83-16972

REGULATORS

Fourth ESTEC spacecraft power-conditioning seminar [ESA-SP-186] p 176 N83-21006

RELATIONSHIPS

Model simplification to examine the interrelationships between coal, gas and oil use [DE82-007816] p 110 N83-18061

RELIABILITY

Maintaining automotive mobility Using fuel economy and synthetic fuels to compete with OPEC oil [DE83-004873] p 37 N83-23245

RELIABILITY ANALYSIS

Operating considerations in reliability of modelling of wind-assisted utility systems p 150 A83-22022
US electric power system reliability [GPO-99-628] p 24 N83-20002

RELIABILITY ENGINEERING

Design options for the SP-100 thermoelectric Nuclear Space Power Plant p 160 A83-27327

REMOTE CONTROL

Design of highwall mining equipment electronic guidance package [DE82-006115] p 108 N83-18005

REMOTE REGIONS

Present and potential use of micro-hydroelectric schemes in remote locations [DE82-904687] p 26 N83-20411

REMOTE SENSING

Main advances and needs on the study of geothermal resources in Chile by using remote sensing techniques p 91 A83-21946

Use of remote sensing techniques to study geothermal resources in arid and semi-arid zones in Chile p 92 A83-24577

Structural geomorphology of Rajasthan basin, India-interpreted through Landsat imagery and aerial photos p 92 A83-24626

Remote-sensing studies of oil-and-gas-bearing territories in the Caspian Basin --- Russian book p 93 A83-25619

The importance of satisfactory positioning, diving and mapping systems, suitable for exploration and transportation in ice-covered sea areas [FOA-B-60003-M7] p 107 N83-17999

The importance of satisfactory positioning, diving and mapping systems suitable for exploration and transportation in icecovered sea areas [PB83-109587] p 123 N83-20342

REMOTE SENSORS

Advanced thermal-sensor-system development via shuttle sortie missions [DE82-004932] p 98 N83-16834

REMOVAL

Alkali-metal-vapor removal from pressurized fluidized-bed combustor flue gas [DE82-008088] p 10 N83-16976

RESEARCH

Solvent-Refined-Coal (SRC) process [DE82-010061] p 107 N83-17743

RESEARCH AND DEVELOPMENT

Present status of R&D for hydrogen production from water in Japan p 86 A83-23701

Electricity from wind - A survey of the state of the art and future prospects for research and development [DGLR PAPER 82-081] p 152 A83-24202

Solar technology - A whether report p 43 A83-25124

Sodium-sulfur battery program in Japan p 189 A83-27175

R and D of energy saving and new energy utilization in Japanese marine engineering p 4 A83-27225

Developments in tidal power p 155 A83-27226

National project of new energy development in Japan p 48 A83-27243

Program overview and diesel/flywheel hybrid power train design - Fibre composite flywheel development program for road vehicle applications p 190 A83-27306

Fibre composite rotor selection and design /Fibre composite flywheel development program for road vehicle applications/ p 190 A83-27307

Analysis of fixed-base flywheel systems for electric utility applications p 190 A83-27310

Program management plan for the conduct of a research, development and demonstration program for improving the safety of nuclear powerplants [DE82-008776] p 19 N83-18555

A survey of manufacturers of solar thermal energy systems [NASA-CR-169924] p 63 N83-19223

Critical need for energy research and development. The role of the Midwest Research Laboratories [GPO-11-308] p 169 N83-19229

Assessment of the basic energy sciences program Volume 2 Appendices [DE82-013245] p 26 N83-20419

Potential benefits of R and D directed toward increasing the cost-effectiveness of energy use [DE83-013435] p 27 N83-20423

Passive-Solar Commercial Buildings Program, 1980 - 1982 [DE82-012472] p 72 N83-21202

US heat-pump research and development projects [DE83-000943] p 31 N83-21536

RESEARCH FACILITIES

Energy and Technology Review [DE82-011840] p 164 N83-16922

Critical need for energy research and development. The role of the Midwest Research Laboratories [GPO-11-308] p 169 N83-19229

RESEARCH MANAGEMENT

Coal research [GPO-99-879] p 123 N83-20366

Building energy research [GPO-11-221] p 25 N83-20370

Assessment of the basic energy sciences program Volume 2 Appendices [DE82-013245] p 26 N83-20419

Research in transportation engineering in the United States p 37 N83-23208

RESEARCH PROJECTS

U K Consortium Stirling engine programme p 157 A83-27285

RESERVES

Development of the oil and gas resources of the United Kingdom. A report to Parliament by the Secretary of State for Energy [ISBN-0-11-411123-5] p 14 N83-18017

A review of world hydrocarbon resource assessments [DE83-900732] p 131 N83-21499

RESERVOIRS

Reservoir engineering transient pressure well testing, and petrophysical analyses of western gas sands [DE82-004879] p 99 N83-16839

RESIDENTIAL ENERGY

Solar residential total energy system using the sodium heat engine - A concept study p 47 A83-27231

Operational results from the Saudi solar village photovoltaic power system p 48 A83-27240

Use of parabolic trough collectors for residential/light commercial solar cooling systems p 48 A83-27245

AQUASTOR - A computer model for cost analysis of aquifer thermal energy storage coupled with district heating or cooling systems p 191 A83-27314

Design and fabrication of a prototype system for a photovoltaic residence in the Northeast [DE82-022497] p 55 N83-16871

Design and fabrication of a prototype system for photovoltaic residences in the Northeast [DE82-022210] p 55 N83-16872

Annual thermal performance of sunspace-type passive-solar collectors for residence heating Attached and semi-enclosed geometries [DE83-002310] p 56 N83-16888

Innovative photovoltaic application for residences experiment [DE83-000399] p 57 N83-16898

Energy Conservation in Historic Structures An information/awareness bulletin p 6 N83-16903

Radon-daughter exposures in energy-efficient buildings [DE82-003711] p 9 N83-16964

Residential end use demand modeling Improvements to the ORNL model [DE82-004925] p 13 N83-17750

Residential-appliance load characteristics [DE82-012883] p 13 N83-17824

Potential for domestic heat recovery [DE82-901395] p 15 N83-18037

Data report for the Northeast Residential Experiment Station, October 1981 [DE82-007648] p 61 N83-18044

Pacific Northwest biomass as an energy resource [DE82-005804] p 110 N83-18047

Energy considerations Mobile homes in the south [DE82-009586] p 17 N83-18068

Development of residential-conservation-survey methodology for the US Air Force Task 2 [DE82-009473] p 18 N83-18077

Competitive assessment of desiccant solar/gas systems for single family residences [PB82-243825] p 62 N83-18967

Overview of existing residential energy-efficiency rating systems and measuring tools [DE83-003148] p 20 N83-19289

Residential and commercial cogeneration systems assessment [PB82-240037] p 22 N83-19314

Analysis and design of residential load centers Volume 2 Appendices [DE82-014253] p 24 N83-19956

Building energy research [GPO-11-221] p 25 N83-20370

Photovoltaic retrofit feasibility in the United States [DE82-014508] p 69 N83-20393

Energy-conserving and passive-solar construction details [DE82-014467] p 76 N83-21569

Solar project description for Gill Harrop Builders single-family detached residence, Big Flats, New York [DE82-014984] p 77 N83-21570

Electric home heating Substitution for oil and gas [DE82-013762] p 133 N83-21581

Engineering development studies for integrated evacuated CPC arrays [DE82-013941] p 77 N83-21583

District-heating system, La Grande, Oregon [DE82-015102] p 32 N83-21593

Residential air-to-air heat exchangers A study of the ventilation efficiencies of wall- or window-mounted units [DE83-004752] p 33 N83-21617

Assessment of distributed solar power systems Issues and impacts [DE83-900640] p 78 N83-21618

Performance and economics of residential solar space heating [DE83-003187] p 79 N83-21626

Performance and economics of 8 alternative systems for residential heating, cooling, and water heating in 115 US cities [DE83-003196] p 33 N83-21630

Investigation of attic insulation effectiveness using actual energy consumption data [DE83-000225] p 36 N83-22828

Performance criteria for solar heating and cooling systems in residential buildings [PB83-122663] p 85 N83-22843

RESISTANCE HEATING

Joule heating effects in MHD generator boundary layers p 161 A83-28956

RESOURCE ALLOCATION

Cartographic evaluation of environmental-management strategies [DE82-009828] p 35 N83-22702

RESOURCES

Two global scenarios The evolution of energy use and the economy to 2030 [IIASA-RR-81-35] p 14 N83-18021

Federal applications for wind energy systems A subcontract report [DE83-000306] p 31 N83-21543

Preliminary evaluation of environmental issues on the use of peat as an energy source [DE83-000820] p 34 N83-21651

Role of energy resources in New Mexico State of California Resource-recovery profile [DE83-004949] p 146 N83-22812

RESOURCES MANAGEMENT

Analytical and policy issues in energy economics Uses of the FRS data base [DE82-004258] p 16 N83-18051

Methane from landfills Preliminary assessment workbook [DE83-002319] p 111 N83-18075

The natural gas option New resources and new technologies [GPO-99-979] p 123 N83-20365

Nuclear power compared with other energy sources A brief comparative study of some of the risks [BLL-CE-TRANS-7745-(9022 09] p 31 N83-21501

RETORT PROCESSING

Isolation of metallic complexes in shale oil and shale oil retort waters [DE82-005931] p 98 N83-16835

Oil shale project run summary small retort run S-7 [DE82-004731] p 99 N83-16837

Simulated in situ retorting of oil-shale in a controlled-state retort 3 Dynamic oil film thickness on partially retorted and unretorted shale [DE82-011107] p 108 N83-18008

Fractionation of an oil shale retort process water Isolation of photoactive genotoxic components [DE82-010428] p 108 N83-18014

Potential biological hazards of nickel arsenides associated with retorting of oil shale Toxic effects of particulate Ni5As2 [DE82-010978] p 22 N83-19328

SUBJECT INDEX

- Geotechnical properties of PARAHO spent shale
[DE83-002633] p 136 N83-21694
- Reverse-combustion, horizontal retorting of oil shale
[DE83-000018] p 137 N83-22350
- RETROFITTING**
- Photovoltaic retrofit feasibility in the United States
[DE82-014508] p 69 N83-20393
- Design and market study of photovoltaic systems for commercial building and applications Volume 3
Appendices
[DE82-016729] p 70 N83-20397
- Geothermal heating facilities for Frontier Inn, Susanville, California
[DE82-015114] p 134 N83-21590
- Converting small industrial boilers to burn wood fuels
[PB83-128116] p 147 N83-22844
- RETROREFLECTORS**
- Evaluation of wind-driven retroreflective taxiway edge markers
[DOT/FAA/RD-82/80] p 94 N83-16353
- REVERSE FIELD PINCH**
- Utilization of the catalyzed-DD fuel cycle in Reversed-Field Pinch Reactors (RFPRs)
[DE82-010425] p 168 N83-18512
- REVERSE OSMOSIS**
- Development and demonstration of a reverse-osmosis energy-recovery device
[PB83-108605] p 140 N83-22380
- REYNOLDS NUMBER**
- Characteristics of coal/light hydrocarbon slurries in spray combustion
[DE82-006294] p 102 N83-17639
- RHEOLOGY**
- Association-solvation characteristic of fuels and lubricating and hydraulic oils
[NASA-TM-76957] p 96 N83-16525
- Degradation and characterization of antimisting kerosene (AMK)
[MED-132] p 120 N83-19922
- Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery
[DE82-008705] p 140 N83-22436
- RIBBONS**
- Optimization of pulling conditions by electronic bombardment of polycrystalline silicon ribbons for solar cells --- French thesis
[NASA-CR-169920] p 63 N83-19219
- RING STRUCTURES**
- Orbital ring systems and Jacob's Ladders III
p 185 A83-29457
- RISK**
- Interim Reliability Evaluation Program (IREP)
[DE82-004132] p 5 N83-16777
- RIVERS**
- Present and potential use of micro-hydroelectric schemes in remote locations
[DE82-904687] p 26 N83-20411
- Definition of cost-effective river-turbine designs
[DE82-010972] p 175 N83-20413
- ROADWAY POWERED VEHICLES**
- Roadway-powered electric-vehicle impact study analysis of selected utility-service areas
[DE83-003143] p 180 N83-22030
- ROBOTS**
- Preliminary analysis of the state of the art of robotics and precision engineering and evaluation of potential for improved energy utilization in the pulp, paper, and related energy-consuming processes
[DE83-001016] p 21 N83-19294
- ROCK INTRUSIONS**
- Geothermal resource assessment of Idaho Springs, Colorado Resource series 16
[DE83-000345] p 110 N83-18073
- ROCKS**
- Use of hot-dry-rock geothermal resources for space heating A case study
[DE83-002947] p 135 N83-21636
- User's manual for HDR3 computer code
[DE83-003993] p 136 N83-21828
- Assessment of the geothermal resources of Kansas
[DE83-003234] p 145 N83-22790
- Geotechnical basis for underground energy storage in hard rock
[DE82-903307] p 198 N83-22836
- ROOFS**
- The design, effectiveness and construction of passive-thermal-control roofing shingles
[DE83-001465] p 75 N83-21557
- ROOM TEMPERATURE**
- An improved portable thermoradiometer /TRM/ for measuring the relative emissivity of solids at room temperature
p 39 A83-20959

ROTARY WINGS

- Stability and response characteristics of one- and two-blade wind turbines
[DGLR PAPER 82-084] p 152 A83-24196
- Force initiations in helicopter rotor blades, wind channel fans and wind turbines
[MBB-UD-356-82-O] p 166 N83-17522
- Linear static and dynamic analysis for hinged rotor blades of 60 m span for a two bladed horizontal axis wind energy converter
[ISD-291] p 167 N83-18030
- ROTATING BODIES**
- Design study of a high power rotary transformer
[NASA-CR-168012] p 186 N83-16630
- ROTATING CYLINDERS**
- Evaluation of wind-driven retroreflective taxiway edge markers
[DOT/FAA/RD-82/80] p 94 N83-16353
- ROTATING DISKS**
- Twin disk composite flywheel
p 189 A83-27304
- ROTATING GENERATORS**
- Modal testing of a rotating wind turbine
[DE83-003630] p 178 N83-21526
- ROTATING SHAFTS**
- Development of a Stirling engine rod seal
p 158 A83-27294
- ROTATION**
- ARLIS 10 Linear investigation of aeroelastic systems in rotation
[ISD-293] p 166 N83-17905
- ROTOR AERODYNAMICS**
- Problem solution areas related to the implementation of the large wind turbine Voith WEC 520
[DGLR PAPER 82-083] p 152 A83-24195
- Stability and response characteristics of one- and two-blade wind turbines
[DGLR PAPER 82-084] p 152 A83-24196
- On aerodynamic design of the Savonius windmill rotor
p 160 A83-27325
- ROTOR BLADES (TURBOMACHINERY)**
- Construction, testing and development of large wind energy facilities
[NASA-TM-76933] p 163 N83-16855
- Force initiations in helicopter rotor blades, wind channel fans and wind turbines
[MBB-UD-356-82-O] p 166 N83-17522
- Linear static and dynamic analysis for hinged rotor blades of 60 m span for a two bladed horizontal axis wind energy converter
[ISD-291] p 167 N83-18030
- Large Horizontal-Axis Wind Turbines
[NASA-CP-2230] p 169 N83-19231
- The response of a 38m horizontal axis teetered rotor to yaw
p 169 N83-19232
- Fixed pitch rotor performance of large horizontal axis wind turbines
p 169 N83-19233
- Stall induced instability of a teetered rotor
p 169 N83-19234
- Free yaw performance of the Mod-0 large horizontal axis 100 kW wind turbine
p 170 N83-19235
- Multiple and variable speed electrical generator systems for large wind turbines
p 170 N83-19236
- Fiberglass composite blades for the 2 MW Mod-1 wind turbine generator
p 170 N83-19241
- Structural fatigue test results for large wind turbine blade sections
p 170 N83-19246
- ROTOR SPEED**
- Fibre composite rotor selection and design /Fibre composite flywheel development program for road vehicle applications/
p 190 A83-27307
- ROTORS**
- Rotary engines
p 152 A83-25140
- Augmentation of power in slow-running vertical-axis wind rotors using multiple vanes
p 160 A83-27868
- Physical properties data compilations relevant to energy storage Part 5 Mechanical properties data on alloys for use in flywheels
[PB82-232919] p 194 N83-18904
- Design of plywood and paper flywheel rotors
[DE83-002276] p 195 N83-20430
- RULES**
- Program management plan for the conduct of a research, development and demonstration program for improving the safety of nuclear powerplants
[DE82-008776] p 19 N83-18555
- RUNWAY LIGHTS**
- Evaluation of wind-driven retroreflective taxiway edge markers
[DOT/FAA/RD-82/80] p 94 N83-16353
- RUPTURING**
- Effect of simulated medium-Btu coal gasifier atmospheres on the biaxial stress rupture behavior of four candidate coal gasifier alloys
[DE82-008607] p 104 N83-17661

SATELLITE SOLAR ENERGY CONVERSION

S

SAFETY

- Interim Reliability Evaluation Program (IREP)
[DE82-004132] p 5 N83-16777
- Health and safety issues of alternate energy systems
[DE82-002918] p 9 N83-16959
- EDS coal-liquefaction process development Phase 5
EDS environmental program
[DE82-005641] p 12 N83-17673
- Identification and mutagenicity of nitrogen-containing polycyclic aromatic compounds in synthetic fuels
[DE82-006173] p 106 N83-17739
- Environmental impacts of underground high-voltage transmission Health and safety
[DE82-010108] p 186 N83-18102
- Development of a continuous methane monitor
[PB82-244245] p 114 N83-19078
- Generic environmental and safety assessment of 5 battery energy-storage systems
[DE82-902212] p 23 N83-19334
- Enhancement of energy savings through accelerated implementation of high-performance forge furnaces
[DE82-010913] p 32 N83-21578
- Research in transportation engineering in the United States
p 37 N83-23208

SAFETY MANAGEMENT

- Technologies for Measurement While Drilling
[PB82-243858] p 114 N83-18964
- Mine personnel locator and mine activity controller
[PB82-235979] p 200 N83-19315
- Safe handling and testing of alternative fuels
[DE82-009176] p 89 N83-21183

SALINITY

- Salt gradient solar pond development
[DE82-020630] p 58 N83-16916

SALT BEDS

- Factors affecting storage of compressed air in solution mined salt cavities
p 191 A83-27311

SALTS

- Performance and operational analysis of a liquid desiccant open-flow solar collector
p 49 A83-27246
- Salt gradient solar pond development
[DE82-020630] p 58 N83-16916
- Preliminary design study of compressed-air energy storage in a salt dome Volume 6 CAES plant design
[DE82-014355] p 196 N83-21580

SAMPLING

- Guidelines for sampling and analyzing solutions for aquifer thermal-energy-storage systems
[DE83-001852] p 10 N83-16973

SANDS

- A geologic study of the Raton Basin
[PB83-136275] p 147 N83-22903
- A geologic study of the Black Warrior Basin
[PB83-136283] p 147 N83-22904

SANDSTONES

- Reservoir engineering transient pressure well testing, and petrophysical analyses of western gas sands
[DE82-004879] p 99 N83-16839

SANDWICH STRUCTURES

- Design, fabrication and test of liquid metal heat-pipe sandwich panels
[NASA-TM-84631] p 187 N83-22541

SATELLITE ANTENNAS

- On the choice of the optimal density of vibrators for a rectenna
p 184 A83-23464

SATELLITE DESIGN

- Distribution voltage for high-power satellites
p 153 A83-27150
- U S welding technology - Constraints to space implementation --- for solar arrays
p 49 A83-27249

SATELLITE OBSERVATION

- Structural geomorphology of Rajasthan basin, India-interpreted through Landsat imagery and aerial photos
p 92 A83-24626

SATELLITE ORIENTATION

- On the orientation precision of satellite solar power stations
p 41 A83-23164

SATELLITE POWER TRANSMISSION (TO EARTH)

- On the orientation precision of satellite solar power stations
p 41 A83-23164
- On the choice of the optimal density of vibrators for a rectenna
p 184 A83-23464
- Optimization technique for improved microwave transmission from multi-solar power satellites
p 185 A83-27152
- Orbital ring systems and Jacob's Ladders III
p 185 A83-29457

SATELLITE SOLAR ENERGY CONVERSION

- Radiative energy receiver for high performance energy conversion cycles
p 46 A83-27138
- Space solar cell technology development - A perspective
p 49 A83-27255
- Current developments in silicon space cells
p 50 A83-27256

SATELLITE SOLAR POWER STATIONS

- Advanced cell designs for welded arrays
p 50 A83-27257
Status of GaAs solar cells for space power applications
p 50 A83-27259

SATELLITE SOLAR POWER STATIONS

- On the orientation precision of satellite solar power stations
p 41 A83-23164
Integration of large electrical space power systems
p 46 A83-27153

SATELLITE-BORNE PHOTOGRAPHY

- Tectonic elements registered on the Landsat imagery in area of Yugoslavia and their practical meaning
p 91 A83-21945
Geology and structures study of the Nuba Mountains, Sudan, using Landsat images
p 92 A83-24561
Use of remote sensing techniques to study geothermal resources in and and semi-and zones in Chile
p 92 A83-24577
Results of the investigation of the oil and gas deposits of Tadzhikistan on the basis of space photographs
p 94 A83-26805

SCALARS

- Joint measurements of radial velocity and scalars in a turbulent diffusion flame
p 86 A83-24365

SCANNERS

- Evaluation of various solar-cell-to-interconnector welds by means of scanning laser acoustic microscopy and metallography
[ESA-STM-225]
p 73 A83-21514

SCHOTTKY DIODES

- Al-Si peaked Schottky barriers
p 40 A83-22903
Experimental and theoretical studies of Cu₂O solar cells
p 40 A83-22907
A model for the collection of minority carriers generated in the depletion region of a Schottky barrier solar cell
p 40 A83-22910

SCRUBBERS

- Development of heat exchangers for reheating scrubbed flue gas in a pilot plant
[BMFT-FB-T-82-169]
p 13 A83-17840
Acid rain mitigation study Volume 1 FGD cost estimates
[PB83-101329]
p 29 A83-20459

SEA ICE

- The importance of satisfactory positioning, diving and mapping systems, suitable for exploration and transportation in ice-covered sea areas
[FOA-B-60003-M7]
p 107 A83-17999
The importance of satisfactory positioning, diving and mapping systems suitable for exploration and transportation in icecovered sea areas
[PB83-109587]
p 123 A83-20342

SEA WATER

- The importance of satisfactory positioning, diving and mapping systems suitable for exploration and transportation in icecovered sea areas
[PB83-109587]
p 123 A83-20342
Development and demonstration of a reverse-osmosis energy-recovery device
[PB83-108605]
p 140 A83-22380

SEALING

- Sealed mini-nickel cadmium battery charging techniques, technical investigation report
[AD-A119826]
p 192 A83-16860

SEALS (STOPPERS)

- Development of a Stirling engine rod seal
p 158 A83-27294
Effects of displacer seal clearance on free-piston Stirling engine performance
p 158 A83-27295
Analysis of thermal and mechanical stresses in the ceramic seal of the 1-MW(th) bench model solar receiver
[DE82-901870]
p 67 A83-20298

SEAWEEDES

- Marine biomass New York state site and species study compositional analysis and systems studies
[PB83-126078]
p 142 A83-22470

SEDIMENT TRANSPORT

- Uranium hydrogeochemical and stream sediment reconnaissance of the St Michael NTMS quadrangle, Alaska
[DE82-009999]
p 99 A83-16844
Application of energy dispersive X-ray fluorescence, ion sensitive electrodes and instrumental neutron activation in geochemical prospecting
[BMFT-FB-T-82-152]
p 111 A83-18123
Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska
[DE82-009666]
p 115 A83-19196

SEDIMENTARY ROCKS

- Investigation of the geothermal potential of the UK The Southampton (Western Esplanade) geothermal well A preliminary assessment of the resource
p 109 A83-18029

SEDIMENTS

- Petroleum contamination Quantification and passive tagging in organisms and sediments
[PB82-254087]
p 113 A83-18880
Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664]
p 115 A83-19197
The relevance of coal geochemistry to coal utilization
p 144 A83-22767

A geologic study of the Raton Basin

- [PB83-136275]
p 147 A83-22903

SEISMIC WAVES

- Subsea permafrost in Harrison Bay, Alaska An interpretation from seismic data
[AD-A121020]
p 125 A83-20479

SEISMOLOGY

- High resolution seismic survey of the Hanna, Wyoming underground coal gasification area
[DE82-006887]
p 112 A83-18137

SELECTIVE SURFACES

- High temperature degradation in cobalt oxide selective absorber
p 53 A83-28942
Properties of oxidized copper surfaces for solar applications I
p 54 A83-29512
Properties of oxidized copper surfaces for solar applications II
p 54 A83-29513

SELF ABSORPTION

- Light transport in planar luminescent solar concentrators - The role of DCM self-absorption --- 4-dicyano-methylene-2-methyl-6-p-dimethyl-H-pyran
p 39 A83-22619

SEMICONDUCTING FILMS

- The growth of Zn₃P₂ by metalorganic chemical vapor deposition --- material for low cost photovoltaic devices
p 45 A83-26065
Factors affecting the efficiency of chemically deposited CdSe based photoelectrochemical cells
p 54 A83-29514

SEMICONDUCTOR DEVICES

- Photoelectrolysis of water under visible light with doped SrTiO₃ electrodes
p 38 A83-20580
Photoelectrochemical processes in bismuth germanium oxide, Bi₂GeO₂ single crystals
p 38 A83-20581
Screen printed interdigitated back contact solar cell [NASA-CASE-LEW-13414-1]
p 68 A83-20374

SEMICONDUCTOR JUNCTIONS

- Single and multijunction space solar cells grown by organometallic vapor phase epitaxy /OM-VPE/
p 50 A83-27260
Open-circuit voltages across two junctions in n / + / -p-p / + / solar cells under high illumination levels
p 51 A83-27976

SEMICONDUCTORS (MATERIALS)

- Status of photovoltaic materials and process technologies
p 38 A83-20435
Amorphous silicon bibliography update - Introduction
p 41 A83-22915
New materials for solar cells - Tandem cells
p 45 A83-26882

Semiconductor photoelectrochemistry

- [NASA-TP-2088]
p 167 A83-18024
Semiconducting polyacetylene materials for energy-conversion applications
[DE82-012320]
p 70 A83-20407

SEPARATION

- Identification and mutagenicity of nitrogen-containing polycyclic aromatic compounds in synthetic fuels
[DE82-006173]
p 106 A83-17739

SEPARATORS

- Cross-linked polyvinyl alcohol films as alkaline battery separators
p 149 A83-20576
Sealed mini-nickel cadmium battery charging techniques, technical investigation report
[AD-A119826]
p 192 A83-16860
Evaluation of production version of the NASA improved inorganic-organic separator
[NASA-TM-30318]
p 166 A83-18022
The electrochemical fluorination of polymeric materials for high energy density aqueous and non-aqueous battery and fuel cell separators
[NASA-CR-167961]
p 177 A83-21056

SERVICE LIFE

- Study of battery accelerated-testing techniques
[DE82-017125]
p 198 A83-22834

SHADES

- Extensor insulating shutter final prototype design
[DE83-004520]
p 33 A83-21616

SHADOWS

- F-chart method applied to large-scale solar collector systems subject to a shadow effect of adjacent collectors
p 37 A83-20136
Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field
[DFVLR-FB-82-27]
p 73 A83-21515

SHAFTS (MACHINE ELEMENTS)

- Development of methodology for horizontal axis wind turbine dynamic analysis
[NASA-CR-168110]
p 181 A83-22747

SHALE OIL

- Isolation of metallic complexes in shale oil and shale oil retort waters
p 98 A83-16835
Oil shale project run summary small retort run S-7
[DE82-004731]
p 99 A83-16837
Fuel-composition and -vaporization effects on combustion-chamber deposits
[DE82-012576]
p 104 A83-17670
Simulated in situ retorting of oil-shale in a controlled-state retort. 3 Dynamic oil film thickness on partially retorted and unretorted shale
[DE82-011107]
p 108 A83-18008
Western oil-shale development, a technology assessment Volume 6 Oil-shale development in the Piceance Creek Basin and potential water-quality changes
[DE82-005659]
p 108 A83-18009
Devonian shale extraction test wells
[DOE/MC-08386/T1]
p 108 A83-18013
Fractionation of an oil shale retort process water Isolation of photoactive genotoxic components
[DE82-010428]
p 108 A83-18014
Western oil shale development A technology assessment Volume 8 Health effects of oil shale development
[DE82-008695]
p 109 A83-18015
Metal recovery from eastern oil shale
[DE82-004052]
p 109 A83-18016
Potential biological hazards of nickel arsenides associated with retorting of oil shale Toxic effects of particulate NiAs₂
[DE82-010978]
p 22 A83-19328
Multiple-tracer gas analyzer
[DE82-017032]
p 120 A83-19876
High performance liquid chromatographic hydrocarbon group-type analyses of mid-distillates employing fuel-derived fractions as standards
[NASA-TM-83072]
p 120 A83-19920
The socioeconomic impacts of synthetic fuels
[GPO-98-702]
p 24 A83-19923
Development of High Frequency Electromagnetic Mapping (HFEM) technology
[DE82-012773]
p 122 A83-19998
A review of world hydrocarbon resource assessments
[DE83-900732]
p 131 A83-21499
Geotechnical properties of PARAHO spent shale
[DE83-002633]
p 136 A83-21694
Stratigraphic variations in oil-shale fracture properties
[DE82-021088]
p 136 A83-21702
Reverse-combustion, horizontal retorting of oil shale
[DE83-000018]
p 137 A83-22350
Exploration deliberations
p 144 A83-22762
Utilization of oil shales and basic research in organic geochemistry
p 144 A83-22766
Assessment of the need for dry cooling, 1981 update
[DE82-009395]
p 146 A83-22803

SHALES

- Devonian shale extraction test wells
[DOE/MC-08386/T1]
p 108 A83-18013
Metal recovery from eastern oil shale
[DE82-004052]
p 109 A83-18016

SHEAR PROPERTIES

- Physical properties data compilations relevant to energy storage Part 5 Mechanical properties data on alloys for use in flywheels
[PB82-232919]
p 194 A83-18904

SHEAR STRESS

- Contact stresses on a thin plate after large displacements to a half parabolic surface
[DE82-006999]
p 63 A83-19136

SHELLFISHES

- Petroleum contamination Quantification and passive tagging in organisms and sediments
[PB82-254087]
p 113 A83-18880

SHIPS

- Flow distribution control characteristics in marine gas turbine waste-heat recovery system Phase 2 Flow distribution control in waste-heat steam generators
[AD-A119310]
p 175 A83-20054

SHOCK HEATING

- Experimental investigation of shock initiated methane-combustion near a wall
p 93 A83-26200

SHOCK WAVES

- Shock initiated ignition in heptane-oxygen-argon mixtures
p 93 A83-26198

SHORT CIRCUIT CURRENTS

- Diffusion length determination in n / + / -p-p / + / structure based silicon solar cells from the intensity dependence of the short-circuit current for illumination from the p / + / side
p 52 A83-27982

SHORT CIRCUITS

- A model for the collection of minority carriers generated in the depletion region of a Schottky barrier solar cell p 40 A83-22910
- High efficiency p+/n-n+/+ back-surface field silicon solar cells with very large short-circuit current densities p 41 A83-22913

SIDESLIP

- Sideslip indication system p 12 N83-17466

SIGNAL PROCESSING

- Development of a continuous methane monitor [PB82-244245] p 114 N83-19078

SILANES

- Effect of an SiC layer on p-n amorphous silicon solar cells p 40 A83-22909
- Optical properties of sputtered Si H [DE82-007072] p 62 N83-18491

SILICA GEL

- Solar-regenerated desiccant dehumidification [DE83-900823] p 83 N83-22809

SILICON

- Amorphous silicon bibliography update - Introduction p 41 A83-22915
- Optimization of pulling conditions by electronic bombardment of polycrystalline silicon ribbons for solar cells --- French thesis p 55 A83-22946
- Large area silicon sheet by EFG [NASA-CR-169920] p 63 N83-19219
- Large area, low cost solar cell development and production readiness [NASA-CR-170037] p 73 N83-21512
- The structure of 110 tilt boundaries in large area solar silicon [NASA-CR-170204] p 81 N83-22744
- Stress studies in EFG [NASA-CR-170205] p 81 N83-22745
- Silicon concentrator cell-assembly development [DE83-001683] p 84 N83-22822
- Advanced silicon-sheet-growth techniques [DE82-017088] p 84 N83-22831

SILICON CARBIDES

- Effect of an SiC layer on p-n amorphous silicon solar cells p 40 A83-22909

SILICON COMPOUNDS

- Optical properties of sputtered Si H [DE82-007072] p 62 N83-18491

SILICON FILMS

- Minimum silicon wafer thickness for ID wafering p 41 A83-22924
- Metal-insulator-semiconductor silicon solar cells p 44 A83-25447
- Amorphous silicon photovoltaic modules p 45 A83-26064

SILICON JUNCTIONS

- Effect of an SiC layer on p-n amorphous silicon solar cells p 40 A83-22909
- High efficiency p+/n-n+/+ back-surface field silicon solar cells with very large short-circuit current densities p 41 A83-22913

SILICON NITRIDES

- Development of technique for air coating and nickel and copper metallization of solar cells [NASA-CR-169938] p 63 N83-19222

SILICONES

- Solar-collector silicon hose life test [DE83-002236] p 83 N83-22798

SIMULATION

- An Energy Crisis Management Simulation for the State of California [RAND/R-2899-CEC] p 25 N83-20363
- Review of hot-gas-desulfurization simulation models [DE82-016265] p 138 N83-22356
- Dynamic simulation of Exxon's Catalytic Coal-Gasification process [DE82-021973] p 146 N83-22823

SINGLE CRYSTALS

- Practical limiting efficiencies for crystalline silicon solar cells p 37 A83-19893
- Photoelectrochemical processes in bismuth germanium oxide, Bi₂GeO₂₀ single crystals p 38 A83-20581
- Current developments in silicon space cells p 50 A83-27256

SIS (SEMICONDUCTORS)

- A semiconductor-insulator-semiconductor CdO-SiO₂-Si solar cell p 41 A83-22912

SITE SELECTION

- Current aspects of wind-energy utilization - Status and prospects in Bulgaria --- wind resources and site selection for industrial applications p 91 A83-22421
- Factors affecting storage of compressed air in solution mined salt cavities p 191 A83-27311
- Compressed-air energy storage preliminary design and site development program in an aquifer Volume 3, part 1 Site Selection study [DE82-001251] p 192 N83-16869

Candidate wind-turbine-generator site summarized meteorological data for the period December 1976 through December 1981 [DE83-000884] p 102 N83-17028

- Site selection and characterization for an underground coal gasification test in Washington State Volume 2 Project details [DE82-010948] p 19 N83-18117
- Large Horizontal-Axis Wind Turbines [NASA-CP-2230] p 169 N83-19231
- Putting wind resource atlases to use p 115 N83-19237

- Approaches to wind resource verification p 116 N83-19238
- Assessing the representativeness of wind data for wind turbine site evaluation p 116 N83-19239
- Wind turbine siting A summary of the state of the art p 116 N83-19240

- Utility experience with two demonstration wind turbine generators p 173 N83-19266
- Meteorological field measurements at potential and actual wind-turbine sites [DE83-001493] p 174 N83-18398

- On-site fuel cell power plant technology development program [PB83-102335] p 176 N83-20437
- On-site fuel cell field test support program [PB83-121723] p 28 N83-20439
- The acquisition of wind rights for wind energy development [DE82-009139] p 32 N83-21597
- Coastal zone wind energy Part 3 A procedure to determine the wind power potential of the coastal zone [DE82-014334] p 134 N83-21598
- Coordination of the onsite fuel cell program [PB83-119545] p 184 N83-22839

SIZE (DIMENSIONS)

- A method to estimate weight and dimensions of small aircraft propulsion gas turbine engines User's guide [NASA-CR-168049] p 162 N83-16343
- Ultrasonically enhanced size reduction of coal [DE82-008679] p 113 N83-18416

SIZE DETERMINATION

- Size effects in DAWT innovative wind energy system design [ASME PAPER 82-WA/SOL-20] p 153 A83-25688

SIZE DISTRIBUTION

- Pore size engineering applied to starved electrochemical cells and batteries p 154 A83-27201

SLAGS

- Cross-sectional current distribution in coal fired diagonal conducting wall MHD generator p 151 A83-23130
- Replacement of lumpy chrome ore by agglomerated ore concentrates and lowering of specific power consumption and improvement of Cr yield by means of improved slag composition in the production of HC ferrochrome [BMFT-FB-T-82-084] p 7 N83-16929

SLURRIES

- Characteristics of coal/light hydrocarbon slurries in spray combustion [DE82-006294] p 102 N83-17639
- The use of slurry fuels in industrial furnaces [TAE-428] p 106 N83-17729
- Further development and evaluation of coal-water mixture technology [DE82-010518] p 106 N83-17736

- Recovery of minerals from US coals [DE82-008173] p 108 N83-18010
- Transport characteristics of alternate slurry fuels [DE82-013508] p 121 N83-19939

- Direct liquefaction of biomass Results from operation of continuous bench scale unit in liquefaction of water slurries of Douglas fir wood [DE82-015703] p 124 N83-20414
- Basic combustion and pollutant-formation processes for pulverized fuels [DE82-013773] p 29 N83-20457

SLURRY PROPELLANTS

- Investigation of slurry fuel performance for use in a ramjet propulsor p 90 A83-21014

SMOKE

- Radiation and smoke from the gas turbine combustor using heavy fuels p 92 A83-23877
- Propagation at 10 microns through smoke produced by atmospheric combustion of diesel fuel p 3 A83-26641

SOCIAL FACTORS

- A preliminary plan for the development of geothermal energy in the town of Gabbs, Nevada [DE82-007602] p 17 N83-18064
- Ownership and usage of small passenger vehicles Findings from the 1977 National Personal Transportation Study [DE82-011045] p 20 N83-18592
- Geothermal energy in Nevada Development and utilization [DE83-001783] p 31 N83-21545

- Role of water in energy development [DE82-011986] p 35 N83-22800
- Research in transportation engineering in the United States p 37 N83-23208

SODIUM

- Critique of conceptual design for removal of sodium from lignite by ion exchange [DE82-010789] p 95 N83-16439
- Analytical and experimental investigations of sodium heat pipes and thermal energy storage systems [AD-A122093] p 195 N83-20375
- Liquefaction behavior of a Canadian subbituminous coal in comparison with several US lignites and subbituminous coals [DE82-021976] p 146 N83-22824

SODIUM COMPOUNDS

- Design considerations in the use of Glauber salt for energy storage [DE82-019289] p 192 N83-16868

SODIUM SULFUR BATTERIES

- Comparison of Na/S and LiAl/FeS batteries p 188 A83-27169
- Sodium-sulfur battery program in Japan p 189 A83-27175
- Development of advanced batteries for utility application [DE82-906459] p 193 N83-16918
- Generic environmental and safety assessment of 5 battery energy-storage systems [DE82-902212] p 23 N83-19334

SOILS

- Preliminary geothermal evaluation of the Mokapu Peninsula on the island of Oahu, Hawaii [AD-A119158] p 117 N83-19378

SOLAR ARRAYS

- An optimization of monolithic photovoltaic series arrays p 38 A83-20751
- Electric power - Looking at regenerative systems p 43 A83-24353
- Amorphous silicon photovoltaic modules p 45 A83-26064
- Comparison of evolving photovoltaic and nuclear power systems for earth orbital applications p 45 A83-27131
- Solar array switching power management p 45 A83-27132
- Solar array power management --- in spacecraft power supplies p 46 A83-27148
- Performance degradation and cleaning of photovoltaic arrays p 48 A83-27236
- Cassegrainian concentrator solar array exploratory development module p 49 A83-27250
- Design of large, low-concentration-ratio solar arrays for low earth orbit applications p 49 A83-27254
- Advanced cell designs for welded arrays p 50 A83-27257
- The loss of power supply probability as a technique for designing stand-alone solar electrical (photovoltaic) systems p 54 A83-29896
- Intermediate photovoltaic system application experiment operational performance report for Lovington Square Shopping Center, Lovington, New Mexico [DE83-000391] p 57 N83-16896
- Process research of non-cz silicon material Low cost solar array project, cell and module formation research area [NASA-CR-169899] p 63 N83-19221
- Low concentration ratio solar array for low Earth orbit multi-100 kW application [NASA-CR-170729] p 67 N83-20360
- Photovoltaic-concentrator technology in the USA [DE82-016399] p 68 N83-20387
- Design, testing, and economics of a 430 W sub p photovoltaic concentrator array for non grid-connected applications [DE82-014687] p 68 N83-20388
- Analysis of temperature data from Martin Marietta solar photovoltaic array [DE82-014258] p 69 N83-20389
- Design of a photovoltaic system for a southeast all-electric residence [DE82-009349] p 69 N83-20394
- Design and market study of photovoltaic systems for commercial building and applications Volume 3 Appendices [DE82-016729] p 70 N83-20397
- Technology of elevated voltage solar arrays Key items test and evaluation Part 2 Simulated LEO-plasma tests [ESA-CR(P)-1646] p 73 N83-21513
- Engineering development studies for integrated evacuated CPC arrays p 77 N83-21583
- Results of the PRDA 35 qualification tests of the BDM concentrating photovoltaic module [DE83-002136] p 78 N83-21613

- Electrical overstress failure in silicon solar cells [DE83-004475] p 80 N83-21637
- Photovoltaic 1-5 curve measurement techniques [DE83-000447] p 80 N83-22534
- Study of solar array switching power management technology for space power system [NASA-CR-167890] p 81 N83-22756
- Automated installation methods for photovoltaic arrays [DE83-004272] p 82 N83-22796
- Intermediate photovoltaic system application experiment operational performance report Volume 1 Dallas - Fort Worth Regional Airport, Texas, July 1982 [DE83-004763] p 84 N83-22819
- SOLAR BLANKETS**
- Lightweight solar array blanket tooling, laser welding and cover process technology [NASA-CR-170209] p 81 N83-22741
- SOLAR CELLS**
- Electrochemical solar cells using CdSe thin film electrodes p 37 A83-19885
- Practical limiting efficiencies for crystalline silicon solar cells p 37 A83-19893
- Origin of the difference in the open circuit voltage between p-n type and n-p type hydrogenated amorphous silicon solar cells p 37 A83-19991
- Status of photovoltaic materials and process technologies p 38 A83-20435
- Chemical bath deposition of thin film cadmium selenide for photoelectrochemical cells p 38 A83-20594
- An optimization of monolithic photovoltaic series arrays p 38 A83-20751
- Solar power applications - Alcohols p 39 A83-21066
- Amorphous silicon - A new semiconductor material for solar cells p 39 A83-21627
- Photoconductivity and photovoltaic effect in indium selenide p 39 A83-22337
- Al-Si peaked Schottky barriers p 40 A83-22903
- Photoelectrochemical behaviour of electrodeposited and pressure-sintered Bi₂S₃, Bi₂S₃-PbS and Bi₂S₃-Ag₂S semiconductor electrodes p 40 A83-22905
- Experimental and theoretical studies of Cu₂O solar cells p 40 A83-22907
- Effect of grain boundaries on the minority carrier diffusion length in InP solar cells p 40 A83-22908
- Effect of an SiC layer on p-n amorphous silicon solar cells p 40 A83-22909
- A model for the collection of minority carriers generated in the depletion region of a Schottky barrier solar cell p 40 A83-22910
- A semiconductor-insulator-semiconductor CdO-SiO₂-Si solar cell p 41 A83-22912
- High efficiency p+/n-n+/p back-surface field silicon solar cells with very large short-circuit current densities p 41 A83-22913
- Accuracy of analytical expressions for solar cell fill factors p 41 A83-22914
- Amorphous silicon bibliography update - Introduction p 41 A83-22915
- Minimum silicon wafer thickness for ID wafering p 41 A83-22924
- Influence of diffusion of hot carriers on collection efficiency of solar cells - a-Si H p 42 A83-23665
- Progress in photovoltaic energy conversion p 42 A83-23859
- Metal-insulator-semiconductor silicon solar cells p 44 A83-25447
- Organic solar cells - A review p 44 A83-25449
- Additional solar spectral data sets p 199 A83-25450
- Amorphous silicon photovoltaic modules p 45 A83-26064
- New materials for solar cells - Tandem cells p 45 A83-26882
- On insolation measurements using pyranometers and solar cell devices p 48 A83-27238
- U.S. welding technology - Constraints to space implementation --- for solar arrays p 49 A83-27249
- Space solar cell technology development - A perspective p 49 A83-27255
- Current developments in silicon space cells p 50 A83-27256
- Advanced cell designs for welded arrays p 50 A83-27257
- Space applications of gallium arsenide solar cells p 50 A83-27258
- Status of GaAs solar cells for space power applications p 50 A83-27259
- Single and multijunction space solar cells grown by organometallic vapor phase epitaxy /OM-VPE/ p 50 A83-27260
- Open-circuit voltages across two junctions in n+/p-p+/p solar cells under high illumination levels p 51 A83-27976
- Computer simulation of the optical behaviour of amorphous silicon solar cells p 51 A83-27979
- Grain boundary effects in polycrystalline silicon solar cells I - Solution of the three-dimensional diffusion equation by the Green's function method II - Numerical calculation of the limiting parameters and maximum efficiency p 52 A83-27981
- Diffusion length determination in n+/p-p+/p structure based silicon solar cells from the intensity dependence of the short-circuit current for illumination from the p+/p side p 52 A83-27982
- Design of antireflection coatings for textured silicon solar cells p 52 A83-27983
- Reactive sputtered Ta₂O₅ antireflection coatings p 52 A83-27984
- The fill factor of a solar cell from a mathematical point of view p 52 A83-27986
- The loss of power supply probability as a technique for designing stand-alone solar electrical (photovoltaic) systems p 54 A83-29896
- Optimization of puling conditions by electronic bombardment of polycrystalline silicon ribbons for solar cells --- French thesis p 55 A83-29946
- Variation in the microstructure of electrodeposited black chrome solar coatings p 56 A83-16878
- [DE81-030842] p 56 A83-16878
- Influence of grain boundaries on solar cell performance [DE82-004662] p 56 A83-16881
- Intermediate photovoltaic system application experiment operational performance report Volume 1 G N Wilcox Memorial Hospital, Kauai, Hawaii p 57 A83-16897
- Polycrystalline solar cell/substrate growth by integrated vacuum evaporation p 58 A83-16917
- [DE82-017203] p 58 A83-16917
- Industrial technology for economic and viable encapsulation for large solar panels [PB82-259839] p 59 A83-16936
- Comparative values of advanced space solar cells [NASA-TM-84951] p 60 N83-18023
- Application of laser annealing and laser-induced diffusion to photovoltaic conversion p 61 A83-18056
- [DE82-006792] p 61 A83-18056
- Effects of grain boundaries in GaAs solar cells [DE82-006118] p 61 A83-18059
- Optical properties of sputtered Si H [DE82-007072] p 62 A83-18491
- Development of metallization process, FSA project, cell and module formation research area [NASA-CR-169902] p 63 A83-19220
- Development of technique for air coating and nickel and copper metallization of solar cells [NASA-CR-169938] p 63 A83-19222
- Solar thermochemical energy conversion and transport [AD-A121318] p 64 A83-19276
- The response of solar cells to microwave radiation [AD-A121813] p 64 A83-19279
- Intermediate photovoltaic system application experiment operational performance report Volume 3 For Mississippi County Community College, Blytheville, Arkansas [DE83-000072] p 65 N83-19293
- Design rules for a 100X maximum efficiency GaAs concentrator solar cell for space applications [NASA-CR-170005] p 67 N83-20362
- Screen printed interdigitated back contact solar cell [NASA-CASE-LEW-13414-1] p 68 A83-20374
- Chalcogenide-glass solar cells [DE82-021243] p 68 A83-20382
- Analysis of temperature data from Martin Manetta solar photovoltaic array [DE82-014258] p 69 A83-20389
- Accelerated aging of GaAs concentrator solar cells [DE82-016658] p 69 A83-20390
- Research on application of Arc-Plasma Spraying (APS) [DE82-015220] p 70 A83-20408
- Design and fabrication of a prototype system for photovoltaic residences in the southwest [DE83-003935] p 72 A83-21200
- Results of the 1982 NASA/JPL balloon flight solar cell calibration program [NASA-CR-170123] p 72 A83-21510
- Large area, low cost solar cell development and production readiness [NASA-CR-170037] p 73 A83-21512
- Evaluation of various solar-cell-to-interconnector welds by means of scanning laser acoustic microscopy and metallography [ESA-STM-225] p 73 A83-21514
- Development of copper sulfide/cadmium sulfide thin-film solar cells [DE83-001421] p 74 A83-21539
- Intermediate photovoltaic system application experiment operational performance report Volume 2 G N Wilcox Memorial Hospital, Kauai, Hawaii [DE83-002139] p 74 A83-21541
- Photovoltaic concentrator with plastic-film reflector [DE83-001715] p 75 N83-21547
- Design and fabrication of a prototype system for photovoltaic residences in the southwestern United States [DE83-002532] p 78 A83-21607
- Results of the PRDA 35 qualification tests of the BDM concentrating photovoltaic module [DE83-002136] p 78 A83-21613
- Additional testing of the passive heat-pipe-cooled solar photovoltaic receiver [DE83-004474] p 78 A83-21615
- Electric power from orbit. A critique of a satellite power system [DE83-002771] p 33 A83-21619
- Design and demonstration of a spectrum-splitting photovoltaic concentrator module [DE83-003669] p 79 A83-21634
- Electrical overstress failure in silicon solar cells [DE83-004475] p 80 N83-21637
- Lightweight solar array blanket tooling, laser welding and cover process technology [NASA-CR-170209] p 81 N83-22741
- Development of technologies for welding interconnects to fifty-micron thick silicon solar cells [NASA-CR-170212] p 81 A83-22742
- Photovoltaic cell and module status assessment Volume 1 Technology overview [DE83-900567] p 82 A83-22791
- Automated installation methods for photovoltaic arrays [DE83-004272] p 82 A83-22796
- Use of inorganic materials for phosphorescent concentrating solar cells [DE83-002860] p 83 A83-22799
- Silicon concentrator cell-assembly development [DE83-001683] p 84 A83-22822
- SOLAR COLLECTORS**
- F-chart method applied to large-scale solar collector systems subject to a shadow effect of adjacent collectors p 37 A83-20136
- Solar receiver cavity insulation evaluation p 39 A83-22275
- Area utilization efficiency of a sloping heliostat system for solar concentration p 39 A83-22618
- Light transport in planar luminescent solar concentrators - The role of DCM self-absorption --- 4-dicyano-methylene-2-methyl-6-p-dimethyl H-pyran p 39 A83-22619
- Effect of argon pressure on the optical properties of sputtered solar selective surfaces p 40 A83-22620
- EA study of solar concentrator panels with fluorescent compounds p 40 A83-22911
- A method of evaluating and sizing solar cogeneration systems p 41 A83-23127
- Configuration selection study for isolated loads --- using parabolic dish modules to supply power for MX shelters p 41 A83-23137
- Numerical calculation of the heat transfer by natural convection in a cubical enclosure p 42 A83-23212
- Transient characteristics of flat-plate solar collector p 42 A83-23333
- Convective losses from cavity solar receivers - Comparisons between analytical predictions and experimental results p 42 A83-23881
- Convective heat losses from flat-plate solar collectors in turbulent winds p 43 A83-23883
- Simplified calculational procedure for determining the amount of intercepted sunlight in an imaging solar concentrator p 43 A83-23884
- Thermal degradation of solar collector surfaces p 44 A83-25535
- The uranyl ion, fluorescent and fluorene-like - A review p 45 A83-26061
- Radiative energy receiver for high performance energy conversion cycles p 46 A83-27138
- Design, fabrication, and initial testing of solar one receiver p 47 A83-27229
- Comparison of advanced thermal and electrical storage for parabolic dish solar thermal power systems p 47 A83-27232
- Evaluation and application of solid thermal energy carriers in a high temperature solar central receiver system p 47 A83-27235
- Evaluation of solar reflective surfaces for dish concentrators p 48 A83-27237
- Development of solar total energy system for industrial sectors p 48 A83-27244
- Use of parabolic trough collectors for residential/light commercial solar cooling systems p 48 A83-27245
- Performance and operational analysis of a liquid desiccant open-flow solar collector p 49 A83-27246
- Cost and performance of thermal storage concepts in solar thermal systems, Phase 2-liquid metal receivers p 51 A83-27316
- High-temperature molten salt solar thermal systems p 51 A83-27317

- Large parabolic dish collectors with small gas-turbine, Stirling engine or photovoltaic power conversion systems p 160 N83-27329
- A probability density function for the clearness index, with applications p 53 N83-28938
- Heat loss coefficients and effective tau-alpha products for flat-plate collectors with diathermanous covers p 53 N83-28939
- The multiple layer solar collector p 53 N83-28940
- High temperature degradation in cobalt oxide selective absorber p 53 N83-28942
- A 2D model of turbulent solar induced flows in passive air collectors p 53 N83-29039
- Flat-plate solar collectors utilizing polymenc film for high performance and very low cost [DE82-004797] p 56 N83-16877
- Comparative report Performance of solar hot-water systems, 1980 - 1981 [DE83-000069] p 56 N83-16889
- Solar district heating with evacuated collectors First year experience of the Knvsta plant [PB82-262114] p 59 N83-16939
- A highly efficient collector for small solar energy installations p 60 N83-16948
- Stability of reflectors with polymenc coatings [DE82-007774] p 60 N83-17723
- An analysis of selected surface characteristics and latent heat storage for passive solar space heating [DE82-006932] p 61 N83-18049
- Solar-absorber-selective paint research [DE82-006104] p 61 N83-18050
- Solar-collector materials exposure to the IPH site environment Task 5 0 [DE83-002192] p 62 N83-18072
- Contact stresses on a thin plate after large displacements to a half parabolic surface [DE82-006998] p 63 N83-19136
- Thermal system engineering experiment [NASA-CR-169901] p 63 N83-19215
- Optimization of dish solar collectors with and without secondary concentrators [NASA-CR-169928] p 64 N83-19224
- The development of solar-assisted gas-fired appliances, phase 2 [PB82-231663] p 66 N83-19312
- Optical measurements p 66 N83-19567
- Thermal-convective-loop correction tests of 316SS and IN800 in molten nitrate salts [DE82-012313] p 66 N83-19898
- Graded-index antireflective coatings for glass [DE82-016756] p 67 N83-19917
- Analysis of thermal and mechanical stresses in the ceramic seal of the 1-MW(th) bench model solar receiver [DE82-901870] p 67 N83-20298
- Airport solar photovoltaic concentrator [DE83-003137] p 68 N83-20384
- Photovoltaic-concentrator technology in the USA [DE82-016399] p 68 N83-20387
- Design, testing, and economics of a 430 W sub p photovoltaic concentrator array for non gnd-connected applications [DE82-014687] p 68 N83-20388
- Flow instability during direct steam generation in a line-focus solar-collector system [DE82-012887] p 70 N83-20404
- Analysis of the economics of typical business applications of solar energy [DE82-013419] p 71 N83-20410
- Photovoltaic/thermal collector development program [DE82-012572] p 71 N83-20416
- Wisconsin collector-efficiency study, phase two [DE82-013425] p 71 N83-20426
- Low-cost, high-performance solar flat-plate collectors for applications in northern latitudes [DE82-010626] p 71 N83-20428
- Design and development of monolithic acrylic Fresnel lenses for use in point-focus PV systems [DE82-007554] p 72 N83-20768
- Effects of gaps in adhesives that bond elastically deformed panels to parabolic, cylindrical substructures [DE82-014720] p 72 N83-21154
- Deformation of a thin, elastic plate to a deep parabolic cylinder [DE82-012056] p 72 N83-21413
- Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field [DFVLR-FB-82-27] p 73 N83-21515
- Solar-energy-system performance evaluation Honeywell OTS 44, Ocmulgee, Georgia [NASA-CR-170031] p 74 N83-21530
- Shading analysis of a photovoltaic-cell string illuminated by a parabolic-trough concentrator [DE83-002646] p 74 N83-21537
- Intermediate photovoltaic system application experiment operational performance report. Volume 2 G N Wilcox Memorial Hospital, Kauai, Hawaii [DE83-002139] p 74 N83-21541
- Photovoltaic concentrator with plastic-film reflector [DE83-001715] p 75 N83-21547
- A 10-MWe solar-thermal central-receiver pilot plant Solar facilities design integration. Plant operating/training manual (RADL-Item 2-36) [DE83-001670] p 75 N83-21551
- Integrated solar heating, cooling, and hot-water system for University City High School, San Diego, California [DE82-020993] p 75 N83-21555
- Central receiver test facility assembly building [DE82-010853] p 76 N83-21567
- Steam generation in line-focus solar collectors A comparative assessment of thermal performance, operating stability and cost issues [DE82-014531] p 76 N83-21568
- Testing and evaluation of second-generation heliostat mirror modules [DE82-007934] p 77 N83-21582
- Engineering development studies for integrated evacuated CPC arrays [DE82-013941] p 77 N83-21583
- Advanced photovoltaic-trough development [DE82-015646] p 77 N83-21584
- Performance testing of the Acurex solar collector model 3001-03 [DE82-013389] p 77 N83-21603
- Results of the PRDA 35 qualification tests of the BDM concentrating photovoltaic module [DE82-002136] p 78 N83-21613
- Design approaches for solar industrial process-heat systems Nontracking and line-focus collector technologies [DE83-003339] p 79 N83-21620
- Optimization of solar-selective paint coatings [DE83-001278] p 80 N83-21642
- Development of polymer film solar collectors A status report [DE83-005995] p 80 N83-21643
- Solar-assisted water-source heat pump [DE82-013981] p 81 N83-22567
- Thermal fatigue tests of Solar One receiver-tube weldments [DE82-012520] p 81 N83-22599
- Program for predicting thermal performance based on test data of low- to medium-temperature line-focusing, concentrating solar collectors [DE82-012605] p 82 N83-22776
- Thermal-receiver designs for line-focus solar collectors [DE82-012067] p 82 N83-22777
- Performance optimization of the ASR optical module [DE83-004477] p 82 N83-22797
- Solar-collector silicon hose life test [DE83-002236] p 83 N83-22798
- Outdoor exposure tests of solar absorptive coatings [PB83-124560] p 84 N83-22840
- Hail impact testing procedure for solar collector covers [PB83-104745] p 84 N83-22841
- SOLAR COOLING**
- SOLERAS solar active cooling field test operations p 48 N83-27239
- Use of parabolic trough collectors for residential/light commercial solar cooling systems p 48 N83-27245
- Contemporary Systems, Inc., Walpole, New Hampshire solar-energy-system performance evaluation [DE83-000068] p 57 N83-16894
- Gill Harrop, Big Flats, New York solar-energy-system performance evaluation [DE83-000065] p 57 N83-16895
- Thermal performance case studies for residential solar heating and cooling systems [PB82-260100] p 59 N83-16940
- Annual cycle energy system performance and national economic comparisons with competitive residential HVAC systems [DE82-010188] p 68 N83-20377
- Solar energy system performance evaluation Honeywell OTS 41, Shenandoah (Newman), Georgia [DE82-021004] p 73 N83-21521
- Solar-energy-system performance evaluation Honeywell OTS 44, Ocmulgee, Georgia [NASA-CR-170031] p 74 N83-21530
- Integrated solar heating, cooling, and hot-water system for University City High School, San Diego, California [DE82-020993] p 75 N83-21555
- The design, effectiveness and construction of passive-thermal-control roofing shingles [DE83-001465] p 75 N83-21557
- Integrated passive-solar demonstration project [DE83-900807] p 82 N83-22795
- Passive-solar homes for Texas [DE83-900806] p 83 N83-22818
- SOLAR CORONA**
- The sun, our star -- Book p 43 N83-24896
- SOLAR ELECTRIC PROPULSION**
- Solar electric technologies Methods of electric utility value analysis [DE82-014285] p 71 N83-20409
- SOLAR ENERGY**
- International Conference on Future Energy Concepts, 3rd, London, England, January 27-30, 1981, Proceedings p 199 N83-24975
- An analysis of the cost/performance characteristics of passive solar materials and components p 49 N83-27247
- Photochemical storage potential of azobenzenes p 191 N83-28941
- Redox ion flow cell for solar energy storage p 54 N83-29407
- Design and construction of a demonstration residence utilizing natural thermal storage [DE82-005508] p 5 N83-16569
- Design and fabrication of a prototype system for a photovoltaic residence in the Northeast [DE82-022497] p 55 N83-16871
- Game-theory approach to consumer incentives for solar energy [DE82-004501] p 56 N83-16882
- Rymark 1, Rymark 2, and Rymark 3, Frederick, Maryland Solar-energy-system performance evaluation, May 1981 through March 1982 [DE83-000067] p 57 N83-16890
- Innovative photovoltaic application for residences experiment [DE83-000399] p 57 N83-16898
- The 1-MW(th) solar-thermal conversion full-system experiment [DE82-906454] p 59 N83-16920
- Penetration for four solar technologies in electric utilities and the environmental benefits [DE82-010864] p 59 N83-16927
- Penetration and air-emission-reduction benefits of solar technologies in the electric utilities [DE82-002637] p 9 N83-16971
- Pacific Northwest biomass as an energy resource [DE82-005804] p 110 N83-18047
- An analysis of selected surface characteristics and latent heat storage for passive solar space heating [DE82-006932] p 61 N83-18049
- Solar-absorber-selective paint research [DE82-006104] p 61 N83-18050
- High-temperature composite latent/sensible heat storage [DE82-010396] p 62 N83-18063
- Energy considerations Mobile homes in the south [DE82-009586] p 17 N83-18068
- Solar energy systems Standards for screening plastic containment materials [PB82-242454] p 62 N83-18921
- Competitive assessment of desiccant solar/gas systems for single family residences [PB82-243825] p 62 N83-18967
- Advanced solar/gas desiccant cooling system [PB82-243833] p 62 N83-18968
- Solar thermochemical energy conversion and transport [AD-A121318] p 64 N83-19276
- Environmental data for sites in the National Solar Data Network [DE82-007055] p 64 N83-19280
- National implications of solar futures A TASE project report [DE82-005122] p 64 N83-19281
- Demonstration of a solar/wind-powered electrostatic-field food-keeping device [DE82-007971] p 65 N83-19285
- Intermediate photovoltaic system application experiment operational performance report. Volume 5 for Lovington Square Shopping Center, Lovington, NM [DE82-006877] p 65 N83-19286
- Steady-state testing of an advanced solar-assisted heat pump [DE83-002343] p 66 N83-19297
- Economic feasibility of solar thermal industrial applications and selected case studies [DE82-009503] p 66 N83-19303
- Photo-induced electron-transfer reactions in heterogeneous media [DE82-005767] p 66 N83-19627
- Performance simulation of the JPL solar-powered distiller. Part 1 Quasi-steady-state conditions ... for cooling microwave equipment p 66 N83-19781
- Survey of the international development in indoor climate control [PB83-100461] p 67 N83-19962

- Solar/gas Brayton/Rankine cycle heat pump assessment
[PB83-102319] p 67 N83-19963
- Renewable energy in the eighties Needs for further R and D
[GPO-99-663] p 25 N83-20367
- US solar and conservation technologies in international markets
[GPO-99-627] p 25 N83-20369
- Photovoltaic-concentrator technology in the USA
[DE82-016399] p 68 N83-20387
- Design, testing, and economics of a 430 W sub p photovoltaic concentrator array for non gnd-connected applications
[DE82-014687] p 68 N83-20388
- Simulation and design of passive processes
[DE82-016647] p 70 N83-20401
- Performance evaluation manual for submetered data collection
[DE82-011223] p 70 N83-20402
- Performance and stability of the mist-lift process for open-cycle OTEC
[DE82-010881] p 175 N83-20403
- Research on application of Arc-Plasma Spraying (APS)
[DE82-015220] p 70 N83-20408
- Solar electric technologies Methods of electric utility value analysis
[DE82-014285] p 71 N83-20409
- Analysis of the economics of typical business applications of solar energy
[DE82-013419] p 71 N83-20410
- Photobiology task of the advanced solar energy research program
[DE82-012310] p 71 N83-20417
- Progress of solar technology and potential farm uses
[PB83-100065] p 71 N83-20436
- Solar-augmented applications in industry Phase 2 Conceptual designs, volume 1
[PB83-102301] p 72 N83-20441
- Solar energy system performance evaluation Honeywell OTS 41, Shenandoah (Newman), Georgia
[DE82-021004] p 73 N83-21521
- Benefits analysis for the production of fuels and chemicals using solar thermal energy
[DE83-001023] p 74 N83-21542
- Energy use test facility CAC-DOE solar air heater test report
[DE83-900162] p 75 N83-21546
- South Carolina energy outlook
[DE83-002121] p 32 N83-21561
- Intermediate photovoltaic system application experiment operational performance executive summary Volume 7 Lovington Square Shopping Center, Lovington, New Mexico
[DE82-014649] p 76 N83-21566
- Central receiver test facility assembly building
[DE82-010853] p 76 N83-21567
- Energy-conserving and passive-solar construction details
[DE82-014467] p 76 N83-21569
- Stress analysis of spherical mirror panels
[DE82-015656] p 77 N83-21585
- Manufacture, distribution, and handling of nitrate salts for solar-thermal applications
[DE83-003317] p 79 N83-21625
- Performance and economics of residential solar space heating
[DE83-003187] p 79 N83-21626
- National implications of high solar and biomass energy growth A technology assessment of solar energy systems The TASE Project
[DE83-004935] p 34 N83-21638
- September 1982 environmental data for sites in the National Solar Data Network
[DE83-001839] p 80 N83-21722
- Study of solar array switching power management technology for space power system
[NASA-CR-167890] p 81 N83-22756
- Intermediate photovoltaic system application experiment operational performance report Volume 5, for Beverly High School, Beverly, Mass
[DE82-012058] p 81 N83-22774
- Thermal-receiver designs for line-focus solar collectors
[DE82-012067] p 82 N83-22777
- Energy-transmission-system heat losses
[DE83-003628] p 187 N83-22786
- Industry/Government Forum on Recent Policy and Budget Changes in the DOE Solar-Thermal Program
[DE82-012511] p 36 N83-22801
- First year's performance data of the NCSU solar energy and conservation house
[DE83-004800] p 83 N83-22808
- Intermediate photovoltaic system experiment operational performance report Volume 3 For G N Wilcox Memorial Hospital, Kauai, Hawaii
[DE83-000801] p 84 N83-22830
- Development of an advanced solar augmented water heater (for single family home applications)
[PB83-119610] p 84 N83-22842
- SOLAR ENERGY ABSORBERS**
- Light transport in planar luminescent solar concentrators - The role of DCM self-absorption --- 4-dicyano-methylene-2-methyl-6-p-dimethyl-H-pyran p 39 A83-22619
- Chemically vapor-deposited black molybdenum films of high IR reflectance and significant solar absorptance p 44 A83-25534
- Radiative energy receiver for high performance energy conversion cycles p 46 A83-27138
- Improved thermophotovoltaic power system p 46 A83-27139
- Heat loss coefficients and effective tau-alpha products for flat-plate collectors with diathermanous covers p 53 A83-28939
- High temperature degradation in cobalt oxide selective absorber p 53 A83-28942
- Properties of oxidized copper surfaces for solar applications I p 54 A83-29512
- Properties of oxidized copper surfaces for solar applications II p 54 A83-29513
- Solar energy systems Standards for screening plastic containment materials
[PB82-242454] p 62 N83-18921
- The design, effectiveness and construction of passive-thermal-control roofing shingles
[DE83-001465] p 75 N83-21557
- SOLAR ENERGY CONVERSION**
- Sunshine project solar photovoltaic program and recent activities in Japan p 37 A83-20137
- The simulation of global radiation p 37 A83-20139
- Photoelectrolysis of water under visible light with doped SrTiO₃ electrodes p 38 A83-20580
- Solar power applications - Alcohols p 39 A83-21066
- The photoreduction of water - A study of a model system --- French thesis p 86 A83-22083
- Finite element analysis of mixed convection applied to the storage of solar energy p 42 A83-23219
- Mesoscale mapping of available hourly solar irradiance by use of data collected by 'Meteosat' p 43 A83-24633
- Solar technology - A whether report p 43 A83-25124
- Can industry afford solar energy p 44 A83-25144
- Organic solar cells - A review p 44 A83-25449
- High-efficiency spacecraft power conversion techniques p 45 A83-27135
- A new strategy for efficient solar energy conversion - Parallel-processing with surface plasmons p 46 A83-27140
- Application of electrochemical energy storage in solar thermal electric generation systems p 47 A83-27179
- Design, fabrication, and initial testing of solar one receiver p 47 A83-27229
- Advanced component research in the solar thermal program p 47 A83-27233
- Operational results from the Saudi solar village photovoltaic power system p 48 A83-27240
- National project of new energy development in Japan p 48 A83-27243
- Solar thermionic energy converter experiment p 51 A83-27301
- The NASA program in Space Energy Conversion Research and Technology p 160 A83-27326
- Intermediate photovoltaic system application experiment operational performance report for Lovington Square Shopping Center, Lovington, New Mexico
[DE83-000391] p 57 N83-16896
- Performance of an experimental photovoltaic-powered house
[DE82-000662] p 58 N83-16908
- The 1-MW(th) solar-thermal conversion full-system experiment
[DE82-906454] p 59 N83-16920
- Health and safety issues of alternate energy systems
[DE82-002918] p 9 N83-16959
- Experimental techniques for the study of photosynthetic water splitting p 89 N83-17668
- Theoretical studies of solar-pumped lasers
[NASA-CR-169890] p 60 N83-17871
- Chalcogenophosphate photoelectrodes
[NASA-CASE-LAR-12958-1] p 60 N83-18025
- Data report for the Northeast Residential Experiment Station, October 1981
[DE82-007648] p 61 N83-18044
- Hybrid solar-wind energy conversion systems meteorological aspects
[DE82-005798] p 61 N83-18053
- Startup experience with a concentrating photovoltaic power system
[DE82-008833] p 62 N83-18069
- Intermediate photovoltaic system application experiment operational performance report Volume 3 For Mississippi County Community College, Blytheville, Arkansas
[DE83-000072] p 65 N83-19293
- 1980 survey and evaluation of utility conservation, load management and solar end-use projects Volume 2 Solar end-use projects
[DE82-901849] p 66 N83-19330
- Photo-induced electron-transfer reactions in heterogeneous media
[DE82-005767] p 66 N83-19627
- Solar for industry
[DE83-003301] p 68 N83-20381
- Semiconducting polyacetylene materials for energy-conversion applications
[DE82-012320] p 70 N83-20407
- Wisconsin collector-efficiency study, phase two
[DE82-013425] p 71 N83-20426
- Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures
[AD-A113883] p 72 N83-20802
- Intermediate photovoltaic system application experiment operational performance report Volume 2 G N Wilcox Memorial Hospital, Kauai, Hawaii
[DE83-002139] p 74 N83-21541
- A 10-MWe solar-thermal central-receiver pilot plant Solar facilities design integration Plant operating/training manual (RADL-Item 2-36)
[DE83-001670] p 75 N83-21551
- Flash photoelectrochemical studies of transient electrode processes important in solar-energy conversion
[DE83-003134] p 76 N83-21560
- Solar project description for Gill Harrop Builders single-family detached residence, Big Flats, New York
[DE82-014984] p 77 N83-21570
- Assessment of distributed solar power systems Issues and impacts
[DE83-900640] p 78 N83-21618
- Environmental effects of solar-thermal power systems Ecological observations during early testing of the Barstow 10-MWe pilot STPS
[DE83-004454] p 85 N83-22856
- SOLAR FLUX**
- Long term solar irradiation heating of black chrome
[DE83-000032] p 58 N83-16909
- Performance optimization of the ASR optical module
[DE83-004477] p 82 N83-22797
- SOLAR FLUX DENSITY**
- Solar furnace for flux gage calibration and thermal-effects testing
[DE82-005769] p 62 N83-18062
- SOLAR FURNACES**
- Solar furnace for flux gage calibration and thermal-effects testing
[DE82-005769] p 62 N83-18062
- SOLAR GENERATORS**
- Regulation of a system with variable structure --- for boilers of solar powered central receivers p 43 A83-24761
- A study of a solar central power plant with a gas turbine - Project Sirocco modelling and control --- French thesis p 53 A83-28652
- Concentrator systems in photovoltaic conversion - Assessment and perspectives --- French thesis p 53 A83-28653
- The 1-MW(th) solar-thermal conversion full-system experiment
[DE82-906454] p 59 N83-16920
- Receiver subsystem analysis report (RADL Item 4-1)
The 10-MWe solar thermal central-receiver pilot plant Solar-facilities design integration
[DE83-001638] p 65 N83-19295
- SOLAR HEATING**
- F-chart method applied to large-scale solar collector systems subject to a shadow effect of adjacent collectors p 37 A83-20136
- Transient analysis of a natural circulation solar water heater with a heat exchanger p 41 A83-23129
- Transient characteristics of flat-plate solar collector p 42 A83-23333
- f-Chart - Predictions and measurements --- of solar heating systems p 42 A83-23880
- Optimal control of solar heating and off-peak energy storage installations p 42 A83-23882
- Direct-contact air/molten salt heat exchange for solar thermal systems p 47 A83-27234
- Thermal energy storage - Air Force user considerations in various modes of operation p 190 A83-27305

- Optimal heat pumps for solar-assisted heat-pump systems
[DE82-004798] p 55 N83-16688
- Design and fabrication of a prototype system for a photovoltaic residence in the Northeast
[DE82-022497] p 55 N83-16871
- Design and fabrication of a prototype system for photovoltaic residences in the Northeast
[DE82-022210] p 55 N83-16872
- Comparative report Performance of solar hot-water systems, 1980 - 1981
[DE83-000069] p 56 N83-16889
- Contemporary Systems, Inc., Walpole, New Hampshire solar-energy-system performance evaluation
[DE83-000068] p 57 N83-16894
- Gill Harrop, Big Flats, New York solar-energy-system performance evaluation
[DE83-000065] p 57 N83-16895
- Intermediate photovoltaic system application experiment operational performance report Volume 1 G N Wilcox Memorial Hospital, Kauai, Hawaii
[DE83-000393] p 57 N83-16897
- Economic evaluation of solar energy systems in commercial buildings Methodology and case studies [PB82-260456] p 165 N83-16938
- Solar district heating with evacuated collectors First year experience of the Knivsta plant
[PB82-262114] p 59 N83-16939
- Thermal performance case studies for residential solar heating and cooling systems
[PB82-260100] p 59 N83-16940
- Solar energy plant as a complement to a conventional heating system Measurement of the storage and consumption of solar energy
[PB82-255209] p 59 N83-16946
- Practical and theoretical analysis of continuous selection of temperature layers in a hot tank by an experimental tank and a simulation model
[BMFT-FB-T-82-171] p 13 N83-17842
- The 5 MW for solar-chemistry development
[DE82-002064] p 60 N83-18043
- Comparison of heat pump water heaters and solar domestic water heaters
[DE82-006117] p 61 N83-18046
- An analysis of selected surface characteristics and latent heat storage for passive solar space heating
[DE82-006932] p 61 N83-18049
- Helio-Thermics, Inc., lot no 8, single family residence, Greenville, South Carolina
[DE82-012822] p 65 N83-19283
- Solar-energy treatment of ceramic tiles
[DE83-000147] p 65 N83-19296
- Annual cycle energy system performance and national economic comparisons with competitive residential HVAC systems
[DE82-010188] p 68 N83-20377
- Evaluation of Mississippi County Community College and Northwest Mississippi Junior College solar power systems
[DE83-004239] p 73 N83-21518
- Solar energy system performance evaluation Honeywell OTS 41, Shenandoah (Newman), Georgia
[DE82-021004] p 73 N83-21521
- Solar-energy-system performance evaluation Honeywell OTS 44, Ocmulgee, Georgia
[NASA-CR-170031] p 74 N83-21530
- Energy use test facility CAC-DOE solar air heater test report
[DE83-900162] p 75 N83-21546
- Integrated solar heating, cooling, and hot-water system for University City High School, San Diego, California
[DE82-020993] p 75 N83-21555
- The design, effectiveness and construction of passive-thermal-control roofing shingles
[DE83-001465] p 75 N83-21557
- Solar project description for Gill Harrop Builders single-family detached residence, Big Flats, New York
[DE82-014984] p 77 N83-21570
- Performance characteristics and design criteria for the thermic diode, a passive thermosyphon solar heating system
[DE82-012455] p 78 N83-21604
- Reliability and design guidelines for combined solar-space-heating and domestic hot-water system
[DE83-003341] p 79 N83-21635
- Power factor controllers
[DE83-000807] p 80 N83-22510
- Integrated passive-solar demonstration project
[DE83-900807] p 82 N83-22795
- Passive-solar homes for Texas
[DE83-900806] p 83 N83-22818
- Intermediate photovoltaic system experiment operational performance report Volume 3 For G N Wilcox Memorial Hospital, Kauai, Hawaii
[DE83-000801] p 84 N83-22830
- Development of an advanced solar augmented water heater (for single family home applications)
[PB83-119610] p 84 N83-22842
- Performance criteria for solar heating and cooling systems in residential buildings
[PB83-122683] p 85 N83-22843
- SOLAR HOUSES**
Design and fabrication of a prototype system for photovoltaic residences in the Northeast
[DE82-022210] p 55 N83-16872
- Thermal performance of the Brookhaven natural thermal storage house
[DE82-005507] p 56 N83-16879
- Annual thermal performance of sunspace-type passive-solar collectors for residence heating Attached and semi-enclosed geometries
[DE83-002310] p 56 N83-16888
- Gill Harrop, Big Flats, New York solar-energy-system performance evaluation
[DE83-000065] p 57 N83-16895
- Innovative photovoltaic application for residences experiment
[DE83-000399] p 57 N83-16898
- Performance of an experimental photovoltaic-powered house
[DE82-000662] p 58 N83-16908
- Solar project description for environmental partnership, Upper Freehold Township, Monmouth County, New Jersey
[DE83-001068] p 58 N83-16911
- Residential-appliance load characteristics
[DE82-012883] p 13 N83-17824
- Helio-Thermics, Inc., lot no 8, single family residence, Greenville, South Carolina
[DE82-012822] p 65 N83-19283
- Design of a photovoltaic system for a southeast all-electric residence
[DE82-009349] p 69 N83-20394
- Design and fabrication of a prototype system for photovoltaic residences in the southwestern United States
[DE83-002532] p 78 N83-21607
- Integrated passive-solar demonstration project
[DE83-900807] p 82 N83-22795
- First year's performance data of the NCSU solar energy and conservation house
[DE83-004800] p 83 N83-22808
- Instrumentation of the Brookhaven Natural Thermal Storage House
[DE83-000267] p 198 N83-22815
- Passive-solar homes for Texas
[DE83-900806] p 83 N83-22818
- SOLAR PHYSICS**
The sun, our star --- Book
[DE83-000806] p 43 N83-24896
- SOLAR PONDS (HEAT STORAGE)**
Regional thermal and electric energy output of salt-gradient solar ponds in the U S
[ASME PAPER 82-WA/SOL-27] p 44 N83-25689
- Twenty years of experience with organic Rankine cycle turbines - Their applicability and use in energy conservation and alternative energy systems
p 3 A83-27207
- Organic rankine cycle coupled to a solar pond by direct-contact heat exchange - selection of a working fluid
[DE82-020998] p 57 N83-16900
- Salt gradient solar pond development
[DE82-020630] p 58 N83-16916
- SOLAR POSITION**
Solar altitude frequency tables
p 39 A83-22617
- SOLAR POWER SATELLITES**
Optimization technique for improved microwave transmission from multi-solar power satellites
p 185 A83-27152
- Design of large, low-concentration-ratio solar arrays for low earth orbit applications
p 49 A83-27254
- SOLAR RADIATION**
The simulation of global radiation
p 37 A83-20139
- Design considerations in the use of Glauber salt for energy storage
[DE82-019289] p 192 N83-16868
- Efficient daylighting in thermally controlled environments
[DE82-003045] p 6 N83-16885
- Long term solar irradiation heating of black chrome
[DE83-000032] p 58 N83-16909
- Design of a vortex-flow solar chemical reactor
[DE83-000031] p 58 N83-16914
- Simulation and design of passive processes
[DE82-016647] p 70 N83-20401
- SOLAR REFLECTORS**
Improved thermophotovoltaic power system
p 46 A83-27139
- Solar-collector materials exposure to the IPH site environment Task 5 0
[DE83-002192] p 62 N83-18072
- Program for predicting thermal performance based on test data of low- to medium-temperature line-focusing, concentrating solar collectors
[DE82-012605] p 82 N83-22776
- SOLAR SEA POWER PLANTS**
Some ocean engineering considerations in the design of OTEC plants
p 155 A83-27224
- The energy of the ocean thermal resource and the second-law efficiency of idealized ocean thermal energy conversion power cycles
[DE83-000449] p 167 N83-18071
- SOLAR SPECTRA**
Additional solar spectral data sets
p 199 A83-25450
- Terrestrial solar spectral data sets
[DE83-000504] p 60 N83-17001
- SOLAR THERMAL ELECTRIC POWER PLANTS**
A method of evaluating and sizing solar cogeneration systems
p 41 A83-23127
- Preliminary test results for the small community solar power system
[ASME PAPER 82-WA/SOL-30] p 44 A83-25687
- Regional thermal and electric energy output of salt-gradient solar ponds in the U S
[ASME PAPER 82-WA/SOL-27] p 44 A83-25689
- Application of electrochemical energy storage in solar thermal electric generation systems
p 47 A83-27179
- Twenty years of experience with organic Rankine cycle turbines - Their applicability and use in energy conservation and alternative energy systems
p 3 A83-27207
- Solar residential total energy system using the sodium heat engine - A concept study
p 47 A83-27231
- Comparison of advanced thermal and electrical storage for parabolic dish solar thermal power systems
p 47 A83-27232
- Development of solar total energy system for industrial sectors
p 48 A83-27244
- Stirling engines for solar power generation in the 50 to 500 kW range
p 50 A83-27274
- Reversible chemical reactions for energy storage in a large-scale heat utility
p 51 A83-27315
- Cost and performance of thermal storage concepts in solar thermal systems, Phase 2-liquid metal receivers
p 51 A83-27316
- High-temperature molten salt solar thermal systems
p 51 A83-27317
- The design and construction of a low power gas turbine for solar energy conversion - An analytical model of operation of the installation in a variable mode --- French thesis
p 52 A83-28647
- A study of a solar central power plant with a gas turbine - Project Sirocco modelling and control --- French thesis
p 53 A83-28652
- A survey of manufacturers of solar thermal energy systems
[NASA-CR-169924] p 63 N83-19223
- Centaur gas-turbine modification and development for solar-fossil hybrid operation
[DE83-900192] p 177 N83-21366
- SOLAR TOTAL ENERGY SYSTEMS**
Solar residential total energy system using the sodium heat engine - A concept study
p 47 A83-27231
- Development of solar total energy system for industrial sectors
p 48 A83-27244
- SOLDERING**
Developments and applications of tantalum thin films and hybrid technology
[BMFT-FB-T-82-173] p 199 N83-17686
- SOLDERS**
Metallurgical aspects of interstrand resistance --- superconducting magnets
[DE82-005504] p 186 N83-17342
- SOLID ELECTRODES**
Electrochemical solar cells using CdSe thin film electrodes
p 37 A83-19885
- Simple porous electrode models for molten carbonate fuel cells
p 149 A83-19891
- Photoelectrolysis of water under visible light with doped SrTiO₃ electrodes
p 38 A83-20580
- A mechanistic study of oxygen evolution on Li-doped Co₃O₄ --- by electrolysis
p 85 A83-20586
- Photoelectrochemical behaviour of electrodeposited and pressure-sintered Bi₂S₃, Bi₂S₃-PbS and Bi₂S₃-Ag₂S semiconductor electrodes
p 40 A83-22905
- SOLID ELECTROLYTES**
Methane synthesis on nickel by a solid-state ionic method
p 91 A83-22324
- Status of solid polymer electrolyte fuel cell technology and potential for transportation applications
p 154 A83-27186
- Basic investigation into the electrical performance of solid electrolyte membranes
[NASA-CR-169790] p 191 N83-16419
- SOLID WASTES**
Municipal-solid-waste biconversion technologies
[DE83-000263] p 100 N83-16893

- Bi-state solid-waste-to-energy project
[DE83-004458] p 28 N83-20435
- Preliminary evaluation of environmental issues on the use of peat as an energy source
[DE83-000820] p 34 N83-21651
- State of California Resource-recovery profile
[DE83-004949] p 146 N83-22812
- SOLIDS**
- An improved portable thermoradiometer /TRM/ for measuring the relative emissivity of solids at room temperature p 39 A83-20959
- Evaluation and application of solid thermal energy carriers in a high temperature solar central receiver system p 47 A83-27235
- Coal pyrolysis by hot solids from a fluidized-bed combustor
[DE83-003344] p 117 N83-19829
- SOLVENT EXTRACTION**
- Identification and removal of the organic compounds in coal-conversion condensate waters
[DE82-004825] p 8 N83-16955
- SOLVENT REFINED COAL**
- Combustion of solvent-refined coal in a 100 HP firetube boiler
[DE82-007670] p 103 N83-17640
- Solvent-Refined-Coal (SRC) Process Coking of SRC-2 process streams Part 3 Effects of coal minerals on coking Part 4 Thermal properties of SRC-2 cokes and process streams
[DE82-012369] p 104 N83-17657
- Solvent-Refined-Coal (SRC) process
[DE82-010061] p 107 N83-17743
- Fossil energy program
[DE82-007496] p 111 N83-18082
- SRC-I solvent-refined-coal process Operation of the solvent-refined-coal pilot plant, Wilsonville, Alabama
[DE82-009931] p 137 N83-22337
- 1980 operation of SRC pilot plant, Wilsonville, Alabama
[DE82-008323] p 137 N83-22339
- Catalytic hydrogenation unit studies
[DE83-003390] p 137 N83-22342
- Effect of liquefaction processing conditions on combustion characteristics of solvent-refined coal
[DE82-903665] p 139 N83-22361
- SOLVENTS**
- Evaluation of production version of the NASA improved inorganic-organic separator
[NASA-TM-83018] p 166 N83-18022
- SONDES**
- High-temperature geothermal cableheads
[DE82-005864] p 117 N83-19302
- SOOT**
- Effect of molecular structure on incipient soot formation p 90 A83-19847
- Diffusion flame studies of the chemical and physical mechanisms of soot formation from aromatic and substituted aromatic fuels
[DE82-009310] p 120 N83-19879
- Continuously adjustable low-power gasifier burner/boiler system
[BMFT-FB-T-82-038] p 131 N83-21507
- Study of net soot formation in hydrocarbon reforming for hydrogen fuel cells
[DE83-001046] p 90 N83-22352
- SORBENTS**
- Leachate-treatment technique utilizing fly ash as low-cost sorbent
[DE82-010501] p 111 N83-18101
- SORGHUM**
- Economic and engineering evaluation of plant oils as a diesel fuel
[DE83-900805] p 141 N83-22464
- SOUTH CAROLINA**
- South Carolina energy outlook
[DE83-002121] p 32 N83-21561
- SPACE COOLING (BUILDINGS)**
- User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 2 Appendices
[DE82-022511] p 99 N83-16866
- Energy Conservation in Historic Structures An information/awareness bulletin
[DE82-005212] p 6 N83-16903
- Competitive assessment of desiccant solar/gas systems for single family residences
[PB82-243825] p 62 N83-18967
- Advanced solar/gas desiccant cooling system
[PB82-243833] p 62 N83-18968
- Technical documentation for the nonresidential-buildings energy-consumption survey, 1979 - 1980, building characteristics, energy end use and fuel oil tank data, public use data tapes Users' guide
[DE82-012523] p 24 N83-19957
- Annual cycle energy system performance and national economic comparisons with competitive residential HVAC systems
[DE82-010188] p 68 N83-20377
- Performance evaluation manual for submetered data collection
[DE82-011223] p 70 N83-20402
- Progress of solar technology and potential farm uses
[PB83-100065] p 71 N83-20436
- Engineering development studies for integrated evacuated CPC arrays
[DE82-013941] p 77 N83-21583
- Performance and economics of 8 alternative systems for residential heating, cooling, and water heating in 115 US cities
[DE83-003196] p 33 N83-21630
- Solar-assisted water-source heat pump
[DE82-013981] p 81 N83-22567
- SPACE ENVIRONMENT SIMULATION**
- A heat pipe simulation technique for spacecraft thermal testing under variable orientation
[SAE PAPER 820860] p 185 A83-25760
- SPACE HEATING (BUILDINGS)**
- t-Chart - Predictions and measurements --- of solar heating systems p 42 A83-23880
- AQUASTOR - A computer model for cost analysis of aquifer thermal energy storage coupled with district heating or cooling systems p 191 A83-27314
- Bellingham Phase 3, Engineering and technology development for a hot-water district-heating system employing thermal-energy storage
[DE82-000108] p 192 N83-16862
- User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 1 Main text
[DE82-022512] p 99 N83-16865
- User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 2 Appendices
[DE82-022511] p 99 N83-16866
- Design considerations in the use of Glauber salt for energy storage
[DE82-019289] p 192 N83-16868
- Rymark 1, Rymark 2, and Rymark 3, Frederick, Maryland Solar-energy-system performance evaluation, May 1981 through March 1982
[DE83-000067] p 57 N83-16890
- Gill Harrop, Big Flats, New York solar-energy-system performance evaluation
[DE83-000065] p 57 N83-16895
- Innovative photovoltaic application for residences experiment
[DE83-000399] p 57 N83-16898
- Energy Conservation in Historic Structures An information/awareness bulletin
[DE82-005212] p 6 N83-16903
- Solar project description for environmental partnership, Upper Freehold Township, Monmouth County, New Jersey
[DE83-001068] p 58 N83-16911
- Electric load of resistance heated one-family houses An empiric analysis
[DE82-901536] p 6 N83-16923
- Evaluation of utility home-energy-audit programs A Wisconsin example
[DE82-008134] p 6 N83-16924
- Economic evaluation of solar energy systems in commercial buildings Methodology and case studies
[PB82-260456] p 165 N83-16938
- Solar district heating with evacuated collectors First year experience of the Knvsta plant
[PB82-262114] p 59 N83-16939
- Heat energy consumption and intermittent heating
[PB82-255159] p 8 N83-16945
- Practical and theoretical analysis of continuous selection of temperature layers in a hot tank by an experimental tank and a simulation model
[BMFT-FB-T-82-171] p 13 N83-17842
- An analysis of selected surface characteristics and latent heat storage for passive solar space heating
[DE82-006932] p 61 N83-18049
- Development of residential-conservation-survey methodology for the US Air Force Task 2
[DE82-009473] p 18 N83-18077
- Competitive assessment of desiccant solar/gas systems for single family residences
[PB82-243825] p 62 N83-18967
- Supernsulated homes in North America A review and update
[DE82-011565] p 21 N83-19290
- Strategies for energy conservation in small office buildings
[PB82-245820] p 22 N83-19306
- 1980 survey and evaluation of utility conservation, load management and solar end-use projects Volume 2 Solar end-use projects
[DE82-901849] p 66 N83-19330
- Technical documentation for the nonresidential-buildings energy-consumption survey, 1979 - 1980, building characteristics, energy end use and fuel oil tank data, public use data tapes Users' guide
[DE82-012523] p 24 N83-19957
- Annual cycle energy system performance and national economic comparisons with competitive residential HVAC systems
[DE82-010188] p 68 N83-20377
- Design and market study of photovoltaic systems for commercial building and applications Volume 3 Appendices
[DE82-016729] p 70 N83-20397
- Performance evaluation manual for submetered data collection
[DE82-011223] p 70 N83-20402
- Progress of solar technology and potential farm uses
[PB83-100065] p 71 N83-20436
- Evaluation of Mississippi County Community College and Northwest Mississippi Junior College solar power systems
[DE83-004239] p 73 N83-21518
- Solar project description for Gill Harrop Builders single-family detached residence, Big Flats, New York
[DE82-014984] p 77 N83-21570
- Use of vegetation to ameliorate building microclimates An assessment of energy-conservation potentials
[DE82-013255] p 32 N83-21572
- Geothermal feasibility study for City of Sonoma, California four municipal buildings
[DE82-015115] p 133 N83-21589
- Geothermal heating facilities for Frontier Inn, Susanville, California
[DE82-015114] p 134 N83-21590
- District-heating system, La Grande, Oregon
[DE82-015102] p 32 N83-21593
- Geothermal-heating facilities for Carson Elementary School and Wind River Middle School
[DE82-015121] p 134 N83-21595
- Performance and economics of residential solar space heating
[DE83-003187] p 79 N83-21626
- Performance and economics of 8 alternative systems for residential heating, cooling, and water heating in 115 US cities
[DE83-003196] p 33 N83-21630
- Reliability and design guidelines for combined solar-space-heating and domestic hot-water system
[DE83-003341] p 79 N83-21635
- Use of hot-dry-rock geothermal resources for space heating A case study
[DE83-002947] p 135 N83-21636
- User's manual for HDR3 computer code
[DE83-003993] p 136 N83-21828
- Possibilities of improving degree of perfection and effectiveness of use of secondary thermal energy resources
[BLL-M-26859-(5825 4)] p 143 N83-22738
- Heat-activated heat-pump development and potential application of Stirling-engine technology
[DE83-002134] p 183 N83-22817
- SPACE INDUSTRIALIZATION**
- Orbital rmg systems and Jacob's Ladders III
[DE82-008134] p 6 N83-16924
- SPACE PLATFORMS**
- Development of management technology for large power systems --- of spacecraft p 46 A83-27147
- SPACE POWER REACTORS**
- Long titanium heat pipes for high-temperature space radiators p 185 A83-27127
- Artery heat pipes for space power systems p 185 A83-27128
- Development of high-temperature liquid metal heat pipes for isothermal irradiation assemblies --- for in-pile tests of UO2 space reactor fuel configurations p 185 A83-27129
- Comparison of evolving photovoltaic and nuclear power systems for earth orbital applications p 45 A83-27131
- Integration of large electrical space power systems p 46 A83-27153
- Nuclear reactors using fine particulate fuel for primary power in space p 155 A83-27221
- Direct conversion nuclear reactor space power systems p 158 A83-27296
- Direct-energy-conversion implications of space nuclear reactors p 159 A83-27297
- Thermionic technology infrastructure for space power p 159 A83-27298
- Design options for the SP-100 thermoelectric Nuclear Space Power Plant p 160 A83-27327

SPACE SHUTTLE ORBITERS

Advanced thermal-sensor-system development via shuttle sortie missions
[DE82-004932] p 98 N83-16834

SPACE SHUTTLES

The Light Weight Radioisotope Heater Unit (LWRHU). A technical description of the reference design
[DE82-014121] p 148 N83-23138
Reentry thermal testing of light-weight radioisotope heater unit
[DE82-014116] p 148 N83-23147

SPACECRAFT COMPONENTS

A heat pipe simulation technique for spacecraft thermal testing under variable orientation
[SAE PAPER 820860] p 185 A83-25760

SPACECRAFT DESIGN

Systems and operations - Living with complexity and growth p 86 A83-24357
Structures and mechanisms - Streamlining for fuel economy p 2 A83-24361
Cassegrainian concentrator solar array exploratory development module p 49 A83-27250

SPACECRAFT POWER SUPPLIES

Electric power - Looking at regenerative systems p 43 A83-24353
Comparison of evolving photovoltaic and nuclear power systems for earth orbital applications p 45 A83-27131
Solar array switching power management p 45 A83-27132
High-efficiency spacecraft power conversion techniques p 45 A83-27135
Radiative energy receiver for high performance energy conversion cycles p 46 A83-27138
Development of management technology for large power systems --- of spacecraft p 46 A83-27147
Solar array power management --- in spacecraft power supplies p 46 A83-27148
Distribution voltage for high-power satellites p 153 A83-27150
Application of microprocessor-based controls in an ac/dc power conversion system p 188 A83-27151
Integration of large electrical space power systems p 46 A83-27153
Spacecraft power technology p 153 A83-27157
Thermoelectric conversion for space nuclear power p 155 A83-27222
US welding technology - Constraints to space implementation --- for solar arrays p 49 A83-27249
Space solar cell technology development - A perspective p 49 A83-27255
Current developments in silicon space cells p 50 A83-27256
Advanced cell designs for welded arrays p 50 A83-27257
Space applications of gallium arsenide solar cells p 50 A83-27258
Status of GaAs solar cells for space power applications p 50 A83-27259
Single and multijunction space solar cells grown by organometallic vapor phase epitaxy /OM-VEPE/ p 50 A83-27260
The NASA program in Space Energy Conversion Research and Technology p 160 A83-27326
Design study of a high power rotary transformer [NASA-CR-168012] p 186 N83-16630
Research on spacecraft electrical power conversion [NASA-CR-169974] p 20 N83-19227
Development of a high capacity toroidal Ni/Cd cell [NASA-CR-169945] p 174 N83-19273
Fourth ESTEC spacecraft power-conditioning seminar [ESA-SP-186] p 176 N83-21006
Energy generating and storing method for space application p 177 N83-21021

SPACECRAFT RADIATORS

Long titanium heat pipes for high-temperature space radiators p 185 A83-27127

SPARK IGNITION

Fleet experience using a methanol/unleaded gasoline blend
[DE83-003834] p 129 N83-21171
The spark-ignition aircraft piston engine of the future p 141 N83-22450
Alternative engine fuels Educational demonstration project
[DE83-004579] p 141 N83-22462
Ignition technique for conventional motors by high energy spark
[INPE-2645-TDL/116] p 142 N83-22594

SPATIAL DISTRIBUTION

Distribution of and changes in industrial carbon dioxide production p 2 A83-24256
Dynamic simulation of sulfur-removal systems
[DE82-902074] p 119 N83-19865

SPECIFICATIONS

Mod-2 wind turbine project assessment and cluster test plans p 172 N83-19262

Status of the 4 MW WTS-4 wind turbine p 172 N83-19263

On-site fuel cell power plant technology development program
[PB83-102335] p 176 N83-20437
SRC-I project Baseline
[DE83-000987] p 127 N83-21086
Technical/commercial feasibility study of the production of fuel-grade ethanol for corn 100-million gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000772] p 129 N83-21173

SPECTRAL ENERGY DISTRIBUTION

The simulation of global radiation p 37 A83-20139

SPECTRAL SENSITIVITY

On insolation measurements using pyranometers and solar cell devices p 48 A83-27238

SPECTRUM ANALYSIS

Design and demonstration of a spectrum-splitting photovoltaic concentrator module
[DE83-003669] p 79 N83-21634

SPENT FUELS

Tritium transport and control in the FED
[DE82-002592] p 168 N83-18511
Radioisotopes for heat-source applications
[DE83-005045] p 137 N83-21934

SPILLING

The effects of weather systems, currents and coastal processes on major oil spills at sea
[AD-A120221] p 8 N83-16953
Recent flame-propagation experiments at LLNL within the liquefied gaseous-fuels spill-safety program
[DE82-010729] p 103 N83-17651

SPONTANEOUS COMBUSTION

First results, problems of French deep gasification program p 107 N83-17765

SPRAY CHARACTERISTICS

Review of alternative fuels data bases
[NASA-CR-170203] p 140 N83-22439

SPRAYERS

Characteristics of coal/light hydrocarbon slurries in spray combustion
[DE82-006294] p 102 N83-17639

SPRAYING

Characteristics of coal/light hydrocarbon slurries in spray combustion
[DE82-006294] p 102 N83-17639
Magnesia spray absorption for the removal of SO2 from flue gas
[DE82-013443] p 28 N83-20456

SPUTTERING

Applications of ion beam technology p 88 N83-16493
[NASA-CR-169797]
Developments and applications of tantalum thin films and hybrid technology
[BMFT-FB-T-82-173] p 199 N83-17686

STABILITY

Performance and stability of the mist-lift process for open-cycle OTEC
[DE82-010881] p 175 N83-20403
Stability analysis of flexible wind turbine blades using finite element method
[NASA-CR-168107] p 177 N83-21508

STABILITY TESTS

EA study of solar concentrator panels with fluorescent compounds p 40 A83-22911
Nonstandard aging tests on coal-derived distillate fuels
[DE82-010442] p 97 N83-16562
Studies of the mechanisms of turbine fuel instability
[NASA-CR-167963] p 114 N83-18924

STAINLESS STEELS

Corrosion of 310 stainless steel in H2-H2O-H2S gas mixtures Studies at constant temperature and fixed oxygen potential p 90 A83-20265
Thermal-convective-loop correction tests of 316SS and IN800 in molten nitrate salts
[DE82-012313] p 66 N83-19898

STANDARDIZATION

Design and standardization of meteorological measurements for wind energy converting systems
[BMFT-FB-T-82-166] p 168 N83-18172

STANDARDS

Additional solar spectral data sets p 199 A83-25450
Development of standards and a cost model for coal agglomeration and related studies
[DE82-011047] p 105 N83-17678
Technical standards for fuel consumption in private automobiles
[DE82-900748] p 106 N83-17735
Solar energy systems Standards for screening plastic containment materials
[PB82-242454] p 62 N83-18921

STATIC INVERTERS

An advanced electric vehicle powertrain p 154 A83-27161

STATISTICAL ANALYSIS

Survey of lands held for uranium exploration, development and production in fourteen western states for the six-month period ending June 30, 1981
[DE82-006228] p 99 N83-16838
Development of statistical databases for toxicological studies
[DE82-005196] p 10 N83-17067
Digest of United Kingdom Energy Statistics, 1982
[ISBN-0-11-411124-3] p 14 N83-18019
Statistical database management for ecosystem-effects analysis
[DE82-005199] p 18 N83-18104
Assessing the representativeness of wind data for wind turbine site evaluation p 116 N83-19239
Energy-data validation An overview and some concepts
[DE82-020901] p 27 N83-20431

STATISTICS

Biostatistics and health impacts of energy technologies p 36 N83-22962

STEADY STATE

Steady-state testing of an advanced solar-assisted heat pump
[DE83-002343] p 66 N83-19297
User's manual for steady-state computer simulation for air-to-air heat pumps with selected examples
[DE83-002446] p 32 N83-21553

STEAM

Catalytic combustion with steam injection
[ASME PAPER 82-JPGC-GT-23] p 93 A83-25271
Steam gasification of wood in the presence of catalysts p 162 N83-16557
Identification and removal of the organic compounds in coal-conversion condensate waters
[DE82-004825] p 8 N83-16955
Methanol synthesis gas from catalytic steam reforming of wood
[DE82-006082] p 106 N83-17734
Steam ejector as an industrial heat pump
[DE82-010194] p 14 N83-17847
Project DEEP STEAM p 111 N83-18078
Thermal system engineering experiment
[NASA-CR-169901] p 63 N83-19215
Catalyzed steam gasification of biomass Phase 3 Biomass Process Development Unit (PDU) construction and initial operation
[DE82-010264] p 124 N83-20415
Bi-state solid-waste-to-energy project
[DE83-004458] p 28 N83-20435
Steam generation in line-focus solar collectors A comparative assessment of thermal performance, operating stability and cost issues
[DE82-014531] p 76 N83-21568
Assessment of the need for dry cooling, 1981 update
[DE82-009395] p 146 N83-22803

STEAM FLOW

Flow instability during direct steam generation in a line-focus solar-collector system
[DE82-012887] p 70 N83-20404

STEAM TURBINES

Metallurgical investigation of disc cracking in the LP-2 turbine at a nuclear power station
[DE82-906428] p 162 N83-16515

STEELS

Some 2 1/4Cr-1 Mo steels for coal-conversion pressure vessels
[DE82-901349] p 105 N83-17707
The iron and steel industry Energy consumption and conservation in the iron and steel industry
[ENERGY-AUDIT-SER-16] p 14 N83-18020
Materials for Coal Conversion and Utilization
[DE82-013244] p 124 N83-20386
Low-alloy steels for thick-walled pressure vessels
[DE83-002547] p 128 N83-21127

STELLAR EVOLUTION

The sun, our star --- Book p 43 A83-24896

STELLARATORS

The stellarator approach to toroidal plasma confinement
[DE82-005727] p 165 N83-17325

STIRLING CYCLE

Whence Stirling engines --- auto and air applications p 156 A83-27265
Whither Stirling engines --- principles and applications p 156 A83-27266
An assessment of the multifuel capability and alternative fuel potential of the automotive Stirling engine /ASE/ p 156 A83-27273
Stirling engines for solar power generation in the 50 to 500 kW range p 50 A83-27274
Further development of the fluidyne liquid-piston engine p 156 A83-27275

- Performance characteristics of wet and dry fluidynes ---
 Stirling cycle engines p 156 A83-27276
 Design of hydraulic output unit for 15 kW free-piston
 Stirling engine p 157 A83-27277
 A new, versatile Stirling energy conversion unit
 p 157 A83-27280
 An isothermal second-order Ringbom-Stirling engine
 computer program p 157 A83-27281
 50 kW Stirling engine p 157 A83-27282
 Design and experiences with a laboratory Stirling cycle
 machine p 157 A83-27284
 U K Consortium Stirling engine programme
 p 157 A83-27285
 A way to relax the dimensional tolerance requirements
 of clearance regenerators --- in small Stirling engine
 design p 158 A83-27286
 Improved Stirling engine performance using jet
 impingement p 158 A83-27288
 Back-to-back test for determining the pumping losses
 in a Stirling cycle machine p 158 A83-27290
 Development of a Stirling engine rod seal
 p 158 A83-27294
 Effects of displacer seal clearance on free-piston Stirling
 engine performance p 158 A83-27295
 A study on two-phase, two-component Stirling engine
 p 160 A83-27328
 Large parabolic dish collectors with small gas-turbine,
 Stirling engine or photovoltaic power conversion
 systems p 160 A83-27329
 Computer program for Stirling engine performance
 calculations p 166 A83-17423
 [NASA-TM-829F0] p 166 A83-17423
 Development of a quiet Stirling cycle multi-fuel engine
 for electric power generation p 174 A83-19278
 [AD-A121033] p 174 A83-19278
 Design of hydraulic output Stirling engine
 [NASA-CR-167976] p 181 A83-22739
 Heat-activated heat-pump development and potential
 application of Stirling-engine technology
 [DE83-002134] p 183 A83-22817
- STOCHASTIC PROCESSES**
 The implications of a stochastic approach to air-quality
 regulations [DE83-001636] p 9 A83-16972
- STOICHIOMETRY**
 Utilization of oil shales and basic research in organic
 geochemistry p 144 A83-22766
- STORAGE BATTERIES**
 The loss of power supply probability as a technique for
 designing stand-alone solar electrical (photovoltaic)
 systems p 54 A83-29896
 High-cycle-life, high-energy-density nickel-zinc
 batteries [DE82-012896] p 195 A83-20376
 Energy generating and storing method for space
 application p 177 A83-21021
- STORAGE STABILITY**
 Nonstandard aging tests on coal-derived distillate
 fuels [DE82-010442] p 97 A83-16562
 Studies of the mechanisms of turbine fuel instability
 [NASA-CR-167963] p 114 A83-18924
- STORAGE TANKS**
 Practical and theoretical analysis of continuous selection
 of temperature layers in a hot tank by an experimental
 tank and a simulation model [BMFT-FB-T-82-171] p 13 A83-17842
- STRATIGRAPHY**
 Stratigraphic variations in oil-shale fracture properties
 [DE82-021088] p 136 A83-21702
 Exploitation deliberations p 144 A83-22763
 Low-temperature geothermal resource and stratigraphy
 of portions of Yakima County, Washington
 [DE83-001433] p 145 A83-22789
- STRATOSPHERE**
 The influence of large-scale advection on the vertical
 distribution of stratospheric source gases in 44 degree
 and 41 degree north p 1 A83-20224
- STREAMLINED BODIES**
 Structures and mechanisms - Streamlining for fuel
 economy p 2 A83-24361
- STREAMS**
 Uranium hydrogeochemical and stream sediment
 reconnaissance of the Tanacross NTMS quadrangle,
 Alaska [DE82-009664] p 115 A83-19197
 Present and potential use of micro-hydroelectric
 schemes in remote locations [DE82-904687] p 26 A83-20411
- STRESS ANALYSIS**
 Minimum silicon wafer thickness for ID wafering
 p 41 A83-22924
 The calculation of energy storage flywheels of fiber
 composites with electric energy converter --- German
 thesis p 191 A83-28666

- Analysis of thermal and mechanical stresses in the
 ceramic seal of the 1-MW(th) bench model solar
 receiver [DE82-901870] p 67 A83-20298
 Effects of gaps in adhesives that bond elastically
 deformed panels to parabolic, cylindrical substructures
 [DE82-014720] p 72 A83-21154
 Stress analysis of spherical mirror panels
 [DE82-015656] p 77 A83-21585
- STRESS CORROSION CRACKING**
 Metallurgical investigation of disc cracking in the LP-2
 turbine at a nuclear power station [DE82-906428] p 162 A83-16515
 Results of u-bend stress-corrosion-cracking specimen
 exposures in coal-liquefaction pilot plants
 [DE82-012889] p 105 A83-17708
 Localized corrosion in materials for geothermal power
 [DE82-015608] p 128 A83-21136
- STRIP MINING**
 Coal p 143 A83-22675
- STRIPPING (DISTILLATION)**
 Identification and removal of the organic compounds
 in coal-conversion condensate waters [DE82-004825] p 8 A83-16955
 SRC-I solvent-refined-coal process. Operation of the
 solvent-refined-coal pilot plant, Wilsonville, Alabama
 [DE82-009931] p 137 A83-22337
- STRONTIUM TITANATES**
 Photoelectrolysis of water under visible light with doped
 SrTiO₃ electrodes p 38 A83-20580
- STRUCTURAL ANALYSIS**
 Design and evaluation of low cost blades for large wind
 driven generating systems p 170 A83-19244
 Structural fatigue test results for large wind turbine blade
 sections p 170 A83-19246
- STRUCTURAL BASINS**
 Structural geomorphology of Rajasthan basin,
 India-interpreted through Landsat imagery and aerial
 photos p 92 A83-24626
 Western oil-shale development, a technology
 assessment. Volume 6 Oil-shale development in the
 Piceance Creek Basin and potential water-quality
 changes [DE82-005659] p 108 A83-18009
 A geologic study of the Michigan Basin
 [P883-136291] p 147 A83-22896
 A geologic study of the Raton Basin
 [P883-136275] p 147 A83-22903
 A geologic study of the Black Warrior Basin
 [P883-136283] p 147 A83-22904
- STRUCTURAL DESIGN**
 Structures and mechanisms - Streamlining for fuel
 economy p 2 A83-24361
 Recent advances in composite flywheel containment
 design technology p 189 A83-27302
 Development of the WTS-4 wind turbine design
 p 159 A83-27323
 The multiple layer solar collector p 53 A83-28940
 New design concepts for energy-conserving buildings
 Results of a national competition among students in
 schools of architecture [DE82-013319] p 24 A83-19950
 Photovoltaic subsystem optimization and design tradeoff
 study [DE82-013393] p 69 A83-20392
 Initial detailed designs for intermediate photovoltaic
 systems Warehouse [DE82-014534] p 69 A83-20396
 The application of DOE-2 in the predesign phase of
 commercial-building design [DE82-014067] p 31 A83-21201
 Design and fabrication of a prototype system for
 photovoltaic residences in the southwestern United
 States [DE83-002532] p 78 A83-21607
 Design, fabrication and test of liquid metal heat-pipe
 sandwich panels [NASA-TM-84631] p 187 A83-22541
 Parametric analysis of closed cycle
 magnetohydrodynamic (MHD) power plants
 [NASA-CR-165472] p 182 A83-22748
- STRUCTURAL PROPERTIES (GEOLOGY)**
 Oxygen isotope exchange in rocks and minerals from
 the Cerro Prieto geothermal system Indicators of
 temperature distribution and fluid flow
 [DE82-001077] p 100 A83-16907
 ERRSAC contributions to the search for Appalachian
 hydrocarbons p 114 A83-19155
 Low-temperature geothermal resource and stratigraphy
 of portions of Yakima County, Washington
 [DE83-001433] p 145 A83-22789
- STRUCTURAL STABILITY**
 Stability and response characteristics of one- and
 two-blade wind turbines [DGLR PAPER 82-084] p 152 A83-24196

- STRUCTURAL WEIGHT**
 A method to estimate weight and dimensions of small
 aircraft propulsion gas turbine engines: User's guide
 [NASA-CR-168049] p 162 A83-16343
 Review and evaluation of automotive fuel conservation
 technologies [PB83-101139] p 30 A83-20844
- SUBMARINE PROPULSION**
 Fuel-cell-propelled submarine-tanker-system study
 [DE82-015149] p 183 A83-22827
- SUBMILLIMETER WAVES**
 Measurement of plasma conductivity using Faraday
 rotation of submillimeter waves p 151 A83-23139
- SUBSTITUTES**
 Systems analysis of hydrogen supplementation in natural
 gas pipelines [DE82-006933] p 89 A83-17740
- SUBSTRATES**
 Polycrystalline solar cell/substrate growth by integrated
 vacuum evaporation [DE82-017203] p 58 A83-16917
 Solar-absorber-selective paint research
 [DE82-006104] p 61 A83-18050
 Screen printed interdigitated back contact solar cell
 [NASA-CASE-LEW-13414-1] p 68 A83-20374
- SUDAN**
 Geology and structures study of the Nuba Mountains,
 Sudan, using Landsat images p 92 A83-24561
- SULFATES**
 The seasonal variation of the atmospheric SO₂ to
 SO₄²⁻ conversion rate p 2 A83-24279
- SULFIDES**
 Vaporization thermodynamics of K₂S and K₂SO₃
 [NASA-CR-168080] p 117 A83-19812
- SULFITES**
 Vaporization thermodynamics of K₂S and K₂SO₃
 [NASA-CR-168080] p 117 A83-19812
- SULFONIC ACID**
 Assessment of phosphoric acid and trifluoromethane
 sulfonic acid fuel cells for vehicular powerplants
 p 154 A83-27162
- SULFUR**
 Rates and equilibria of devolatilization and trace element
 evolution in coal pyrolysis [PB82-260944] p 96 A83-16460
 Trends in motor gasoline, 1942 - 1981
 [DE82-021124] p 96 A83-16550
 Dynamic simulation of sulfur-removal systems
 [DE82-002074] p 119 A83-19865
 Summary of recommendations on basic research
 p 35 A83-22761
- SULFUR COMPOUNDS**
 Instrumental methods of analysis of sulfur compounds
 in synfuel process streams [DE82-011559] p 95 A83-16446
 Status report on sulfur iodine thermochemical
 water-splitting cycle [DE82-007164] p 88 A83-17633
 Relationship between pyrite formation and organic sulfur
 content of coal as revealed by electron microscopy
 [DE82-010417] p 104 A83-17652
- SULFUR DIOXIDES**
 The seasonal variation of the atmospheric SO₂ to
 SO₄²⁻ conversion rate p 2 A83-24279
 The kinetics and mechanism of the reaction of ozone
 with sulphides [BLL-OA-TRANS-1934-(6196 3)] p 94 A83-16411
 Costs to reduce sulfur dioxide emissions
 [DE82-013309] p 28 A83-20451
 Magnesia spray absorption for the removal of SO₂ from
 flue gas [DE82-013443] p 28 A83-20456
- SULFUR OXIDES**
 The kinetics and mechanism of the reaction of ozone
 with sulphides [BLL-OA-TRANS-1934-(6196 3)] p 94 A83-16411
- SULFURIC ACID**
 Sulfuric acid/water chemical heat pump/chemical
 energy storage, phases 1 and 2, phases 3 and 4
 [DE83-001255] p 195 A83-20380
- SUN**
 The sun, our star --- Book p 43 A83-24896
 Stress analysis of spherical mirror panels
 [DE82-015656] p 77 A83-21585
- SUNFLOWERS**
 Economic and engineering evaluation of plant oils as
 a diesel fuel [DE83-900805] p 141 A83-22464
- SUNLIGHT**
 Simplified calculational procedure for determining the
 amount of intercepted sunlight in an imaging solar
 concentrator p 43 A83-23884
 Design and demonstration of a spectrum-splitting
 photovoltaic concentrator module [DE83-003669] p 79 A83-21634

SUBJECT INDEX

SUPERCHARGERS
Supercharging with Comrex p 168 N83-18940

SUPERCONDUCTING MAGNETS
Metallurgical aspects of interstrand resistance --- superconducting magnets p 186 N83-17342
Desulphurization of solid fuels in power stations by superconducting magnets [BLL-CE-TRANS-7855-(9022 09)] p 125 N83-21051

SUPERCONDUCTIVITY
Superconductive energy storage [DE83-002270] p 196 N83-21624

SUPERCONDUCTORS
Materials research for hydrogen-cooled Superconducting Power-Transmission Lines (SPTL) Part 1. Liquid hydrogen as a dielectric Part 2. Superconducting materials [DE83-004801] p 187 N83-22529

SUPERCRITICAL FLOW
Extraction of coal with solvents in liquid and supercritical state under nonhydrogenating and hydrogenating conditions [BMFT-FB-T-82-177] p 109 N83-18032

SUPERSONIC COMBUSTION
A study on the hydrogen-oxygen diffusion flame in high speed flow p 93 A83-26199

SUPERSONIC COMBUSTION RAMJET ENGINES
Using a global hydrogen-air combustion model in turbulent reacting flow calculations p 86 A83-24667

SUPPLYING
Oil and Gas Supply Modeling [PB82-234139] p 117 N83-19310
World oil [DE82-906440] p 27 N83-20433

SURFACE LAYERS
Effect of argon pressure on the optical properties of sputtered solar selective surfaces p 40 A83-22620

SURFACE PROPERTIES
Properties of oxidized copper surfaces for solar applications I p 54 A83-29512
Properties of oxidized copper surfaces for solar applications II p 54 A83-29513
Linear static and dynamic analysis for hinged rotor blades of 60 m span for a two bladed horizontal axis wind energy converter [ISD-291] p 167 N83-18030

SURFACE REACTIONS
Thermal degradation of solar collector surfaces p 44 A83-25535

SURFACE ROUGHNESS EFFECTS
The use of mechanical energy storage in an unconventional, rough terrain vehicle p 190 A83-27309

SURFACE VEHICLES
A system of hydrogen-powered vehicles with liquid organic hydrides p 88 A83-27340
Vehicle conversion to hybrid gasoline/alternative fuel operation [NASA-CR-169911] p 115 N83-19216
Roadway-powered electric-vehicle project [DE83-003147] p 184 N83-23243

SURVEILLANCE
Environmental radiation surveillance program [DE82-902009] p 19 N83-18116

SURVEYS
The Wind Characteristics Program [DE82-005226] p 101 N83-17023
World-wide resource assessment [DE82-004272] p 102 N83-17024
Development of residential-conservation-survey methodology for the US Air Force Task 2 [DE82-009473] p 18 N83-18077
Introduction to the nonresidential buildings energy-consumption survey 1979-1980 building characteristics, energy end use and fuel oil tank data Public use data tapes, shoppers' guide [DE82-012522] p 27 N83-20424
State of California Resource-recovery profile [DE83-004949] p 146 N83-22812

SWAGING
Development of a high capacity toroidal Ni/Cd cell [NASA-CR-169945] p 174 N83-19273

SWITCHING CIRCUITS
Solar array switching power management p 45 A83-27132
Study of solar array switching power management technology for space power system [NASA-CR-167890] p 81 N83-22756

SYNTHESIS (CHEMISTRY)
Methane synthesis on nickel by a solid-state ionic method p 91 A83-22324
Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels [PB82-255167] p 96 N83-16459

SYNTHETIC FUELS
A viable process for producing hydrogen synfuel using nuclear fusion heat p 87 A83-27210
Is LH2 the high cost option for aircraft fuel p 87 A83-27215
Instrumental methods of analysis of sulfur compounds in synfuel process streams [DE82-011559] p 95 N83-16446
Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels [PB82-255167] p 96 N83-16459
Chemical effects in vaporizing synthetic fuels [DE82-003352] p 96 N83-16549
Steam gasification of wood in the presence of catalysts [DE82-005919] p 162 N83-16557
Environmetrics of synfuels Part 4 Project Results Tracking System (PRTS) [DE82-011444] p 10 N83-16977
Synthetic fuel effects in continuous combustion systems An experimental study of fuel nitrogen conversion in jet-stirred combustions [DE82-002686] p 103 N83-17646
Catalytic coal gasification An emerging technology for SNG [DE82-007596] p 104 N83-17676
H-Coal Pilot Plant Phase 2 Construction and Phase 3 Operation [DE82-005117] p 106 N83-17732
Identification and mutagenicity of nitrogen-containing polycyclic aromatic compounds in synthetic fuels [DE82-006173] p 106 N83-17739
Synthetic-fuel aromaticity and staged combustion [DE82-010302] p 118 N83-19858
The socioeconomic impacts of synthetic fuels [GPO-98-702] p 24 N83-19923
Integrated forecasting model synthetic fuels study Volume 1. Overview and findings [DE82-903574] p 121 N83-19943
Publications in life sciences synthetic fuels of Oak Ridge National Laboratory [DE83-001701] p 122 N83-19945
Refining studies and engine testing of alternative highway-transportation fuels Identification and evaluation of optimized alternative fuels [DE83-003332] p 129 N83-21172
Technical/commercial feasibility study of the production of fuel-grade ethanol for corn 100-million gallon-per-year production facility in Myrtle Grove, Louisiana [DE83-000772] p 129 N83-21173
Assessment of methane-related fuels for automotive fleet vehicles Volume 1 Executive summary [DE83-000280] p 130 N83-21185
Workshop on the Federal Role in Synfuels Development [PB83-102236] p 30 N83-21187
Benefits analysis for the production of fuels and chemicals using solar thermal energy [DE83-001023] p 74 N83-21542
Flash pyrolysis of biomass with reactive and non-reactive gases [DE83-001850] p 137 N83-22336
Review of alternative fuels data bases [NASA-CR-172023] p 140 N83-22439
Motor-fuels for road vehicles [REPT-24] p 140 N83-22440
Workshop report on Basic Research in Organic Geochemistry Applied to National Energy Needs [DE82-007074] p 144 N83-22760
Conversion of coal to synthetic fuels p 144 N83-22768
Toxicology of coal gasification Chemical characterization p 148 N83-22960
Alternative motor fuels p 148 N83-23214
Maintaining automotive mobility Using fuel economy and synthetic fuels to compete with OPEC oil [DE83-004873] p 37 N83-23245

SYSTEM EFFECTIVENESS
A method of evaluating and sizing solar cogeneration systems p 41 A83-23127

SYSTEMS ANALYSIS
A systems analysis comparing conventional and hydrogen powered rail locomotives p 87 A83-27213
A study of a solar central power plant with a gas turbine - Project Sirocco modelling and control --- French thesis p 53 A83-28652
Interim Reliability Evaluation Program (IREP) [DE82-004132] p 5 N83-16777
Systems analysis of hydrogen supplementation in natural gas pipelines [DE82-006933] p 89 N83-17740
Two global scenarios The evolution of energy use and the economy to 2030 [IIASA-RR-81-35] p 14 N83-18021

Two level multi-objective reconnaissance system study of a large water resource system [PB82-239716] p 20 N83-19213
Systems analysis of on-site integrated energy systems, phase 1 [DE83-000044] p 179 N83-21549

SYSTEMS ENGINEERING
Control design for a wind turbine-generator using output feedback p 152 A83-24721
Improved thermophotovoltaic power system p 46 A83-27139
Spacecraft power technology p 153 A83-27157
Some ocean engineering considerations in the design of OTEC plants p 155 A83-27224
Evaluation and application of solid thermal energy carriers in a high temperature solar central receiver system p 47 A83-27235
Conceptual design of the 6 MW Mod-5A wind turbine generator p 173 N83-19271
Initial detailed designs for intermediate photovoltaic systems Branch bank [DE82-005854] p 65 N83-19287
Conceptual design study Standard Floating Nuclear Power Plant on inshore site and Modified Floating Nuclear Power plant on upriver site [DE82-007916] p 174 N83-19595
Fusion technology status and requirements [DE82-010754] p 174 N83-19615
Photovoltaic subsystem optimization and design tradeoff study [DE82-013393] p 69 N83-20392
Initial detailed designs for intermediate photovoltaic systems Warehouse [DE82-014534] p 69 N83-20396
Design and market study of photovoltaic systems for commercial building and applications Volume 3 Appendices [DE82-016729] p 70 N83-20397
Research in transportation engineering in the United States p 37 N83-23208

SYSTEMS INTEGRATION
Systems and operations - Living with complexity and growth p 86 A83-24357
Integration of large electrical space power systems p 46 A83-27153
An advanced electric vehicle powertrain p 154 A83-27161
Integration of Wind Turbine Generation (WTG) into utility generating systems p 171 N83-19249

SYSTEMS MANAGEMENT
Development of management technology for large power systems --- of spacecraft p 46 A83-27147
Solar array power management --- in spacecraft power supplies p 46 A83-27148

SYSTEMS SIMULATION
SHEBMS Small Hydroelectric Basin Modeling System [DE82-015411] p 183 N83-22832

SYSTEMS STABILITY
Application of multivariable systems theory, Symposium, Plymouth, England, October 26-28, 1982, Collected Papers p 151 A83-23171

T

TABLES (DATA)
Solar altitude frequency tables p 39 A83-22617
Survey of lands held for uranium exploration, development and production in fourteen western states for the six-month period ending June 30, 1981 [DE82-006228] p 99 N83-16838
Intermediate photovoltaic system application experiment operational performance report Volume 1 G N Wilcox Memorial Hospital, Kauai, Hawaii [DE83-000393] p 57 N83-16897
Candidate wind-turbine-generator site summarized meteorological data for the period December 1976 through December 1981 [DE83-000884] p 102 N83-17028
Digest of United Kingdom Energy Statistics, 1982 [ISBN-0-11-41124-3] p 14 N83-18019
Multiple-task services for the Division of Geothermal Energy's hydrothermal-resources program [DE82-009007] p 110 N83-18070
Motor gasoline, summer 1981 [DE82-014425] p 121 N83-19924
Dissolved methane concentrations in the southeast Bering Sea, 1980 and 1981 [PB83-112433] p 29 N83-20525
September 1982 environmental data for sites in the National Solar Data Network [DE83-001839] p 80 N83-21722
Assessment of the geothermal resources of Kansas Volume 2 Appendices, section 3 [DE83-003222] p 143 N83-22697

TAKEOFF RUNS

TAKEOFF RUNS

- An approach to helicopter power selection
p 3 A83-24828

TANKER SHIPS

- Fuel-cell-propelled submarine-tanker-system study
[DE82-015149] p 183 N83-22827

TANTALUM OXIDES

- Reactive sputtered Ta₂O₅ antireflection coatings
p 52 A83-27984

TARS

- Formation/decomposition of condensable hydrocarbons during the gasification of coal
[DE82-014493] p 119 N83-19866
Coal-gasification and tar-conversion reactions over calcium oxide
[DE82-014635] p 139 N83-22358

TAXIING

- Evaluation of wind-driven retroreflective taxiway edge markers
[DOT/FAA/RD-82/80] p 94 N83-16353

TECHNOLOGICAL FORECASTING

- Whither Stirling engines — principles and applications
p 156 A83-27266
Decision framework for technology choice Volume 1
A case study of one utility's coal-nuclear choice
[DE82-902213] p 113 N83-18554
National implications of solar futures A TASE project report
[DE82-005122] p 64 N83-19281
Oil and Gas Supply Modeling
[PB82-234139] p 117 N83-19310
Program for predicting thermal performance based on test data of low- to medium-temperature line-focusing, concentrating solar collectors
[DE82-012605] p 82 N83-22776

TECHNOLOGIES

- West Europe report Science and technology, no 134
[JPRS-82686] p 199 N83-17761

TECHNOLOGY ASSESSMENT

- Status of photovoltaic materials and process technologies
p 38 A83-20435
Progress in photovoltaic energy conversion
p 42 A83-23859
Advances in wind energy technology
[DGLR PAPER 82-082] p 151 A83-24194
Electricity from wind - A survey of the state of the art and future prospects for research and development
[DGLR PAPER 82-081] p 152 A83-24202
Solar technology - A whether report
p 43 A83-25124
Ocean thermal-energy conversion
p 152 A83-25125
Metal-insulator-semiconductor silicon solar cells
p 44 A83-25447
Miami International Conference on Alternative Energy Sources, 5th, Miami Beach, FL, December 13-15, 1982, Proceedings of Condensed Papers p 3 A83-25575
Development of management technology for large power systems — of spacecraft p 46 A83-27147
Spacecraft power technology p 153 A83-27157
Assessment of phosphoric acid and trifluoromethane sulfonic acid fuel cells for vehicular powerplants
p 154 A83-27162
Current research in advanced water electrolysis in the United States and abroad p 87 A83-27216
Space solar cell technology development - A perspective p 49 A83-27255
Current developments in silicon space cells
p 50 A83-27256
Whence Stirling engines — auto and air applications
p 156 A83-27265
Thermionic technology infrastructure for space power
p 159 A83-27298
Thermal performance of the Brookhaven natural thermal storage house
[DE82-005507] p 56 N83-16879
An assessment of wind characteristics and wind energy conversion systems for electric utilities
[PB82-258971] p 165 N83-16935
Opportunities for direct-contact waste heat recuperators for industrial heat recovery
[DE82-006280] p 15 N83-18038
The promise and status of international applications of photovoltaics
[DE82-006152] p 16 N83-18042
Tritium transport and control in the FED
[DE82-002592] p 168 N83-18511
Decision framework for technology choice Volume 1
A case study of one utility's coal-nuclear choice
[DE82-902213] p 113 N83-18554
Wind turbine siting A summary of the state of the art
p 116 N83-19240

Preliminary analysis of the state of the art of robotics and precision engineering and evaluation of potential for improved energy utilization in the pulp, paper, and related energy-consuming processes
[DE83-001016] p 21 N83-19294

Fusion technology status and requirements
[DE82-010754] p 174 N83-19615

World oil
[DE82-906440] p 27 N83-20433

Advanced gasification projects
[DE83-003616] p 126 N83-21069

Assessment of research directions for high-voltage direct-current power systems
[DE83-001118] p 177 N83-21247

Technology of elevated voltage solar arrays Key items test and evaluation Part 2 Simulated LEO-plasma tests
[ESA-CR(P)-1646] p 73 N83-21513

A technology assessment of solar energy systems
Direct combustion of wood and other biomass in industrial boilers
[DE83-000937] p 31 N83-21538

Benefits analysis for the production of fuels and chemicals using solar thermal energy
[DE83-001023] p 74 N83-21542

Guide for the assessment of the availability of gasification-combined-cycle power plants
[DE82-901905] p 77 N83-21579

Assessment of distributed solar power systems Issues and impacts
[DE83-900640] p 78 N83-21618

Economic and engineering evaluation of plant oils as a diesel fuel
[DE83-900805] p 141 N83-22464

Assessment of methane-related fuels for automotive fleet vehicles Volume 2 Technical, supply and economic assessments
[DE82-013287] p 142 N83-22467

Assessment for methane-related fuels for automotive fleet vehicles Volume 3 Appendices
[DE82-013190] p 142 N83-22468

Uranium
p 143 N83-22677

Fuel-cell technology assessment. Volume 2 Evaluation of Japan
[DE83-004146] p 182 N83-22771

Fuel-cell technology assessment Volume 3 Evaluation of Tunisia
[DE83-004294] p 182 N83-22772

Fuel-cell technology assessment Volume 5 Evaluation of South Korea
[DE83-004299] p 182 N83-22773

Photovoltaic cell and module status assessment
Volume 1 Technology overview
[DE83-900567] p 82 N83-22791

Fuel-cell technology assessment Volume 4 Evaluation of Taiwan
[DE83-004160] p 183 N83-22810

Fuel-cell technology assessment Volume 1 The potential value of US fuel-cell technology in foreign countries
[DE83-004372] p 183 N83-22820

Synthetic fuels for transportation Background paper
1 The future potential of electric and hybrid vehicles
[PB83-126086] p 37 N83-23250

TECHNOLOGY TRANSFER

American technology transfer and Soviet energy planning
[GPO-97-481] p 26 N83-20373

Passive-Solar Commercial Buildings Program, 1980 - 1982
[DE82-012472] p 72 N83-21202

Energygrams Brief descriptions of energy technology
[DE83-001868] p 35 N83-22792

TECHNOLOGY UTILIZATION

US welding technology - Constraints to space implementation — for solar arrays
p 49 A83-27249

The promise and status of international applications of photovoltaics
[DE82-006152] p 16 N83-18042

TECTONICS

Tectonic elements registered on the Landsat imagery in area of Yugoslavia and their practical meaning
p 91 A83-21945

TEETERING

The response of a 38m horizontal axis teetered rotor to yaw
p 169 N83-19232

Stall induced instability of a teetered rotor
p 169 N83-19234

TELECOMMUNICATION

Future analysis, forecasting and planning for telecommunications, energy and public utilities
[RAND-P-6796] p 20 N83-18978

Activities report in space research in the Federal Republic of Germany
p 200 N83-19702

TELEMETRY

Design of highwall mining equipment electronic guidance package
[DE82-006115] p 108 N83-18005

Technologies for Measurement While Drilling
[PB82-243858] p 114 N83-18964

TELEVISION RECEPTION

Initial utility experience with cluster of three Mod-2 wind turbine systems
p 173 N83-19268

TEMPERATURE CONTROL

Thermal control - Heat buses will operate like a public utility
p 184 A83-24358

Efficient daylighting in thermally controlled environments
[DE82-003045] p 6 N83-16885

Heat energy consumption and intermittent heating
[PB82-255159] p 8 N83-16945

Strategies for energy conservation in small office buildings
[PB82-245820] p 22 N83-19306

Survey of the international development in indoor climate control
[PB83-100461] p 67 N83-19962

The Light Weight Radiosotope Heater Unit (LWRHU)
A technical description of the reference design
[DE82-014121] p 148 N83-23138

TEMPERATURE DEPENDENCE

Corrosion of 310 stainless steel in H₂-H₂O-H₂S gas mixtures Studies at constant temperature and fixed oxygen potential
p 90 A83-20265

TEMPERATURE DISTRIBUTION

Thermal-convection-loop study of the corrosion of Fe-Ni-Cr alloys by molten NaNO₂/sub 3-KNO₃/sub 3
[DE83-004228] p 80 N83-22407

TEMPERATURE EFFECTS

Properties of oxidized copper surfaces for solar applications I
p 54 A83-29512

Association-solvation characteristic of fuels and lubricating and hydraulic oils
[NASA-TM-76957] p 96 N83-16525

Solar furnace for flux gage calibration and thermal-effects testing
[DE82-005769] p 62 N83-18062

Low-temperature pyrolysis of coal to produce diesel-fuel blends
[DE83-001637] p 126 N83-21076

Fuel/engine/airframe trade-off study Operational effects of increased freeze point fuels
[AD-A121688] p 129 N83-21169

TEMPERATURE GRADIENTS

A highly efficient collector for small solar energy installations
[PB82-255191] p 60 N83-16948

TEMPERATURE MEASUREMENT

Environmental data for sites in the National Solar Data Network
[DE82-007055] p 64 N83-19280

Analysis of temperature data from Martin Manetta solar photovoltaic array
[DE82-014258] p 69 N83-20389

Additional testing of the passive heat-pipe-cooled solar photovoltaic receiver
[DE-83-004474] p 78 N83-21615

TEMPERATURE PROFILES

Stress studies in EFG
[NASA-CR-170205] p 81 N83-22745

TENSILE STRESS

A study of bolting problems, tools, and practices in the nuclear industry
[DE82-902203] p 168 N83-19099

TERMINAL FACILITIES

The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations --- (Los Angeles)
p 11 N83-17459

TERRAIN ANALYSIS

Spectra over complex terrain in the surface layer
[DE83-000502] p 102 N83-17027

TEST EQUIPMENT

Development of a Stirling engine rod seal
p 158 A83-27294

TEST FACILITIES

Advanced component research in the solar thermal program
p 47 A83-27233

Solar thermionic energy converter experiment
p 51 A83-27301

Energy use test facility CAC-DOE solar air heater test report
[DE83-900162] p 75 N83-21546

Central receiver test facility assembly building
[DE82-010853] p 76 N83-21567

Ventilated wall and window test passive-solar concept
[DE83-900824] p 78 N83-21614

TEST VEHICLES

Fleet experience using a methanol/unleaded gasoline blend
[DE83-003834] p 129 N83-21171

TETHERED BALLOONS

- Vertical sampling flights in support of the 1981 ASCOT cooling tower experiments Field effort and data [DE82-014269] p 135 N83-21661

TEXAS

- A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas [DE83-004095] p 135 N83-21686

TEXTILES

- Economic feasibility of solar thermal industrial applications and selected case studies [DE82-009503] p 66 N83-19303

THEMATIC MAPPING

- Remote-sensing studies of oil-and-gas-bearing terrones in the Caspian Basin --- Russian book p 93 A83-25619
Interpolation and transformations of maps --- French thesis p 94 A83-28632

THERMAL DEGRADATION

- Thermal degradation of solar collector surfaces p 44 A83-25535
High temperature degradation in cobalt oxide selective absorber p 53 A83-28942
Variation in the microstructure of electrodeposited black chrome solar coatings p 56 N83-16878

THERMAL ENERGY

- Can industry afford solar energy p 44 A83-25144
Regional thermal and electric energy output of salt-gradient solar ponds in the U S [ASME PAPER 82-WA/SOL-27] p 44 A83-25689
Evaluation and application of solid thermal energy carriers in a high temperature solar central receiver system p 47 A83-27235
Bellingham Phase 3, Engineering and technology development for a hot-water district-heating system employing thermal-energy storage [DE82-000106] p 192 N83-16862
Cogeneration feasibility Otis Elevator Company and Polychrome Corporation p 7 N83-16942
Cost of heat from a seasonal source [DE82-006026] p 194 N83-18045
Photovoltaic/thermal collector development program [DE82-012572] p 71 N83-20416
Utilization of secondary energy resources at Magnitogorsk Metallurgical Combine [BLL-M-26856-(5828 4)] p 131 N83-21502
Applications guide for waste heat recovery [NASA-CR-170121] p 178 N83-21511
Benefits analysis for the production of fuels and chemicals using solar thermal energy [DE83-001023] p 74 N83-21542
User's manual for HDR3 computer code [DE83-003993] p 136 N83-21828
Possibilities of improving degree of perfection and effectiveness of use of secondary thermal energy resources [BLL-M-26859-(5825 4)] p 143 N83-22738
Industry/Government Forum on Recent Policy and Budget Changes in the DOE Solar-Thermal Program [DE82-012511] p 36 N83-22801

THERMAL INSULATION

- Solar receiver cavity insulation evaluation p 39 A83-22275
Evaluation of utility home-energy-audit programs A Wisconsin example p 6 N83-16924
Investigation of attic-insulation effectiveness using actual energy-consumption data [DE82-006822] p 17 N83-18055
Supersaturated homes in North America A review and update p 21 N83-19290
Exterior insulating shutter final prototype design [DE83-004520] p 33 N83-21616
Instrumentation of the Brookhaven Natural Thermal Storage House [DE83-000267] p 198 N83-22815

THERMAL MAPPING

- Mesoscale mapping of available hourly solar irradiance by use of data collected by 'Meteosat' p 43 A83-24633
Advanced thermal-sensor-system development via shuttle sortie missions [DE82-004932] p 98 N83-16834

THERMAL PROTECTION

- Thermionic converters for terrestrial applications p 159 A83-27299

THERMAL RESISTANCE

- Fiat researchers study ceramics applications in desels p 199 N83-17760

THERMAL SIMULATION

- Reentry thermal testing of light-weight radioisotope heater unit [DE82-014116] p 148 N83-23147

THERMAL STABILITY

- Thermal control - Heat buses will operate like a public utility p 184 A83-24358
Experimental study of the thermal stability of hydrocarbon fuels [NASA-CR-168027] p 105 N83-17728
Studies of the mechanisms of turbine fuel instability [NASA-CR-167963] p 114 N83-18924
Catalytic coal liquefaction [DE83-001098] p 127 N83-21078

THERMAL STRESSES

- Analysis of thermal and mechanical stresses in the ceramic seal of the 1-MW(th) bench model solar receiver [DE82-901870] p 67 N83-20298

THERMIONIC CONVERTERS

- Thermionic technology infrastructure for space power p 159 A83-27298
Thermionic converters for terrestrial applications p 159 A83-27299
Cogeneration using a thermionic combustor p 159 A83-27300
Solar thermionic energy converter experiment p 51 A83-27301
The plasmadynamics and ionization kinetics of thermionic energy conversion [DE82-012938] p 176 N83-20421

THERMIONIC DIODES

- Thermionic converters for terrestrial applications p 159 A83-27299

THERMIONIC POWER GENERATION

- Research needs Prime-power for high energy space systems [AD-A120209] p 163 N83-16861
The plasmadynamics and ionization kinetics of thermionic energy conversion [DE82-012938] p 176 N83-20421

THERMOCHEMICAL PROPERTIES

- Sulfuric acid/water chemical heat pump/chemical energy storage, phases 1 and 2, phases 3 and 4 [DE83-001255] p 195 N83-20380
A technology assessment of solar energy systems Direct combustion of wood and other biomass in industrial boilers [DE83-000937] p 31 N83-21538

THERMOCHEMISTRY

- Status report on sulfur iodine thermochemical water-splitting cycle [DE82-007164] p 88 N83-17633
Solar thermochemical energy conversion and transport [AD-A121318] p 64 N83-19276
Catalytic coal liquefaction [DE83-001098] p 127 N83-21078

THERMODYNAMIC CYCLES

- A concept of heat pipe engine p 154 A83-27208
Analyses of mixed hydrocarbon binary thermodynamic cycles for moderate temperature geothermal resources [DE82-006272] p 164 N83-16904
The energy of the ocean thermal resource and the second-law efficiency of idealized ocean thermal energy conversion power cycles [DE83-000449] p 167 N83-18071

THERMODYNAMIC EFFICIENCY

- The effect of parasitic refrigeration on the efficiency of magnetic liquefiers p 155 A83-27212
A study on two-phase, two-component Stirling engine p 160 A83-27328
Advanced solar/gas desiccant cooling system [PB82-243833] p 82 N83-18868
Photovoltaic/thermal collector development program [DE82-012572] p 71 N83-20416
Design, fabrication and test of liquid metal heat-pipe sandwich panels [NASA-TM-84631] p 187 N83-22541

THERMODYNAMIC PROPERTIES

- Thermodynamic properties for natural gas binaries [PB82-254616] p 98 N83-16565
Sperry low-temperature geothermal conversion system Volume 1 Organic-working-fluid properties [DE82-018529] p 163 N83-16887
Computer program for Stirling engine performance calculations [NASA-TM-829601] p 166 N83-17423
Study based on ammonia/water solutions of a district heating transport system [BMFT-FB-T-82-188] p 186 N83-18033
Vaporization thermodynamics of K2S and K2SO3 [NASA-CR-168080] p 117 N83-19812
Development of a thermodynamic properties correlation framework for the coal conversion industry, phase 2 [DE82-009866] p 148 N83-23190

THERMODYNAMICS

- Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States [DE82-011237] p 18 N83-18108

- Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field [DFVLR-FB-82-27] p 73 N83-21515

- The variable pressure supercritical Rankine cycle for integrated natural gas and power production from the geopressed geothermal resource [DE82-008957] p 179 N83-21591

- Program for predicting thermal performance based on test data of low- to medium-temperature line-focusing, concentrating solar collectors [DE82-012605] p 82 N83-22776

THERMOELECTRIC GENERATORS

- Design options for the SP-100 thermoelectric Nuclear Space Power Plant p 160 A83-27327

THERMOELECTRIC POWER GENERATION

- Thermoelectric conversion for space nuclear power p 155 A83-27222

THERMOPHYSICAL PROPERTIES

- Some basic research problems related to energy [DE83-003753] p 195 N83-21527

THERMOPLASTICITY

- Relationships between coal constitution, thermoplastic properties and liquefaction behavior of coals and vitrinite concentrates from the lower Kittanning seam, part 1 [DE82-012848] p 118 N83-19860

THERMOSIPHONS

- Transient analysis of a natural circulation solar water heater with a heat exchanger p 41 A83-23129

THIN FILMS

- Electrochemical solar cells using CdSe thin film electrodes p 37 A83-19885
Chemical bath deposition of thin film cadmium selenide for photoelectrochemical cells p 38 A83-20594
Chemically vapor-deposited black molybdenum films of high IR reflectance and significant solar absorptance p 44 A83-25534
Thermal degradation of solar collector surfaces p 44 A83-25535
Computer simulation of the optical behaviour of amorphous silicon solar cells p 51 A83-27979
Design of antireflection coatings for textured silicon solar cells p 52 A83-27983
Factors affecting the efficiency of chemically deposited CdSe based photoelectrochemical cells p 54 A83-29514

- Basic investigation into the electrical performance of solid electrolyte membranes [NASA-CR-169790] p 191 N83-16419

- Developments and applications of tantalum thin films and hybrid technology [BMFT-FB-T-82-173] p 199 N83-17686

- Effects of grain boundaries in GaAs solar cells [DE82-006118] p 61 N83-18059

- Large area silicon sheet by EFG [NASA-CR-169920] p 63 N83-19219

- Development of copper sulfide/cadmium sulfide thin-film solar cells [DE83-001421] p 74 N83-21539

- Hail impact testing procedure for solar collector covers [PB83-104745] p 84 N83-22841

THIN PLATES

- Contact stresses on a thin plate after large displacements to a half parabolic surface [DE82-006998] p 63 N83-19136

- Deformation of a thin, elastic plate to a deep parabolic cylinder [DE82-012058] p 72 N83-21413

THIOUREAS

- The structure of the double layer at the mercury-phosphoric acid interface from studies of adsorption of thiourea and its implications on oxygen reduction kinetics --- in fuel cells p 149 A83-19876

THIXOTROPY

- Investigation of slurry fuel performance for use in a ramjet propulsor p 90 A83-21014

THRESHOLD CURRENTS

- Analytical investigation of axial field limitations in MHD generators p 151 A83-23126

THRUST MEASUREMENT

- The MCA method, a flight test technique to determine the thrust of jet aircraft in flight --- Mass Consumption Acceleration p 1 A83-19661

TIDAL FLATS

- Examination of tidal flats Volume 3 Evaluation methodology [PB83-131805] p 148 N83-22949

TIDE POWERED GENERATORS

- Developments in tidal power p 155 A83-27226

TIDEPOWER

- Manne power - Accomplishments of the 1970s p 155 A83-27223

TILES

- Solar-energy treatment of ceramic tiles [DE83-000147] p 65 N83-19296

TIME DEPENDENCE

The assessment of variable valve timing of internal combustion engines for fuel economy improvements and practicability

[PB82-265364] p 5 N83-16766

Thermal-convection-loop study of the corrosion of Fe-Ni-Cr alloys by molten NaNO₃/sub 3-KNO₃

[DE83-004228] p 80 N83-22407

TIME LAG

Study of psychophysiological distinctions of primates using delayed reaction test

p 85 N83-26442

TIN

Development of technique for air coating and nickel and copper metallization of solar cells

[NASA-CR-169938] p 63 N83-19222

TIRES

Applications of ion beam technology

[NASA-CR-169797] p 88 N83-16493

Review and evaluation of automotive fuel technologies

Volume 1. Summary [PB83-101147] p 30 N83-20845

TITANIUM

Long titanium heat pipes for high-temperature space radiators

p 185 A83-27127

TOKAMAK DEVICES

HYFIRE A Tokamak/high-temperature electrolysis system

[DE82-004806] p 88 N83-17323

The stellarator approach to toroidal plasma confinement

[DE82-005727] p 165 N83-17325

Survey of nuclear fusion technology A prospect analysis of Tokamak fusion research

[DE82-700131] p 168 N83-18451

HYFIRE A Tokamak/high-temperature electrolysis system

[DE82-013851] p 90 N83-23173

TOLERANCES (MECHANICS)

A way to relax the dimensional tolerance requirements of clearance regenerators --- in small Stirling engine design

p 158 A83-27286

TOOLING

Lightweight solar array blanket tooling, laser welding and cover process technology

[NASA-CR-170209] p 81 N83-22741

TOROIDAL PLASMAS

The stellarator approach to toroidal plasma confinement

[DE82-005727] p 165 N83-17325

TOROIDS

Development of a high capacity toroidal Ni/Cd cell

[NASA-CR-169945] p 174 N83-19273

TORQUE

A study of bolting problems, tools, and practices in the nuclear industry

[DE82-902203] p 168 N83-19099

TOWERS

Vertical sampling flights in support of the 1981 ASCOT cooling tower experiments

Field effort and data [DE82-014269] p 135 N83-21661

TOWING

Aircraft towing feasibility study

p 11 N83-17458

TOXIC HAZARDS

Is nuclear energy an unacceptable hazard to health?

[DE82-004954] p 9 N83-16961

The Illinois State Geological Survey The next quarter century

p 112 N83-18139

Heavy Gas Dispersal

[VKI-LS-1982-03] p 200 N83-19316

Geotoxic materials in the surface environment

[DE82-005855] p 23 N83-19333

Publications in life sciences synthetic fuels of Oak Ridge National Laboratory

[DE83-001701] p 122 N83-19945

Toxicology of coal gasification

Chemical characterization p 148 N83-22960

TOXICITY

Environmental quality research Fate of toxic jet fuel components in aquatic systems

[AD-A122548] p 30 N83-21168

TOXICOLOGY

Development of statistical databases for toxicological studies

[DE82-005196] p 10 N83-17067

Geotoxic materials in the surface environment

[DE82-005855] p 23 N83-19333

Toxicology of coal gasification

Chemical characterization p 148 N83-22960

TOXINS AND ANTITOXINS

Fractionation of an oil shale retort process water: Isolation of photoactive genotoxic components

[DE82-010428] p 108 N83-18014

TRACE ELEMENTS

Isolation of metallic complexes in shale oil and shale oil retort waters

[DE82-005931] p 98 N83-16835

Trace and minor element reactions in fluidized-bed combustion processes

[PB82-240219] p 113 N83-18883

Utilization of oil shales and basic research in organic geochemistry

p 144 N83-22766

TRACERS

Vertical sampling flights in support of the 1981 ASCOT cooling tower experiments

Field effort and data [DE82-014269] p 135 N83-21661

TRADEOFFS

A practical economic criterion for fuel conservation

p 12 N83-17468

TRAINING ANALYSIS

Study of psychophysiological distinctions of primates using delayed reaction test

p 85 N83-26442

TRANSFORMATIONS (MATHEMATICS)

Interpolation and transformations of maps --- French thesis

p 94 A83-28632

TRANSFORMERS

Design study of a high power rotary transformer

[NASA-CR-168012] p 186 N83-16630

TRANSIENT RESPONSE

Flash photoelectrochemical studies of transient electrode processes important in solar-energy conversion

[DE83-003134] p 76 N83-21560

TRANSITION METALS

Isolation of metallic complexes in shale oil and shale oil retort waters

[DE82-005931] p 98 N83-16835

Desulfurization with transition-metal catalysis

[DE82-013964] p 118 N83-19853

Desulfurization with transition metal catalysts

[DE83-003062] p 126 N83-21071

Use of inorganic materials for phosphorescent concentrating solar cells

[DE83-002860] p 83 N83-22799

TRANSMISSION LINES

Electrical generation

p 143 N83-22676

TRANSMISSION LOSS

On the orientation precision of satellite solar power stations

p 41 A83-23164

TRANSPORT AIRCRAFT

Fuel for future transport aircraft

p 85 A83-20082

Fuel conservation techniques in jet transport aircraft operations

p 12 N83-17463

TRANSPORT PROPERTIES

Photoconductivity and photovoltaic effect in indium selenide

p 39 A83-22337

Recovery of minerals from US coals

[DE82-008173] p 108 N83-18010

Solar thermochemical energy conversion and transport

[AD-A121318] p 64 N83-19276

Transport characteristics of alternate slurry fuels

[DE82-013508] p 121 N83-19939

TRANSPORTATION

Assessment of battery buses and battery technology

[PB82-260019] p 11 N83-17428

The importance of satisfactory positioning, diving and mapping systems suitable for exploration and transportation in icecovered sea areas

[PB83-109587] p 123 N83-20342

Refining studies and engine testing of alternative highway-transportation fuels

Identification and evaluation of optimized alternative fuels

[DE83-003332] p 129 N83-21172

TRANSPORTATION ENERGY

The relative attractiveness of electric and hybrid passenger cars

p 3 A83-27159

Acid fuel cell technologies for vehicular power plants

p 154 A83-27185

Status of solid polymer electrolyte fuel cell technology and potential for transportation applications

p 154 A83-27186

An assessment of the multifuel capability and alternative fuel potential of the automotive Stirling engine /ASE/

p 156 A83-27273

Recent advances in composite flywheel containment design technology

p 189 A83-27302

Development and implementation of dynamic methodologies for evaluating energy conservation strategies

[PB82-240763] p 21 N83-19304

Development and implementation of dynamic methodologies for evaluating energy conservation strategies

Executive summary [PB82-240771] p 21 N83-19305

Feasibility evaluation of fuel cells for selected heavy-duty transportation systems

[DE83-002953] p 179 N83-21550

Prospects of motor vehicles as a means of transportation and of alternative drives

p 148 N83-23215

TRANSPORTATION NETWORKS

Transportation network models for energy supply analysis

Volume 1 Executive summary [DE82-903077] p 187 N83-20399

Transportation network models for energy supply analysis

Volume 3 Transportation network model user's guide and documentation

[DE82-903079] p 187 N83-20400

Research in transportation engineering in the United States

p 37 N83-23208

TRITIUM

Tritium transport and control in the FED

[DE82-002592] p 168 N83-18511

TROMBE WALLS

Central receiver test facility assembly building

[DE82-010853] p 76 N83-21567

TROUGHES

Advanced photovoltaic-trough development

[DE82-015646] p 77 N83-21584

TRUCKS

Demonstration of modification of a gasoline spark-ignited engine to permit using ethanol as a fuel

[DE83-001384] p 114 N83-19101

Diesel technology

[GPO-99-748] p 25 N83-20151

A study of emissions from light duty vehicles in San Antonio, Texas, year 2

[PB83-124743] p 36 N83-22867

TUBE HEAT EXCHANGERS

Solar district heating with evacuated collectors

First year experience of the Knivsta plant

[PB82-262114] p 59 N83-16939

TURBINE BLADES

Numerical determination of the configuration of a rotating blade with constant stress --- for vertical axis wind turbines

p 150 A83-22020

Aerodynamic tests of Darrieus wind turbine blades

p 151 A83-23128

The effects of tower shadow on the dynamics of a horizontal-axis wind turbine

p 160 A83-27869

Metallurgical investigation of disc cracking in the LP-2 turbine at a nuclear power station

[DE82-906428] p 162 N83-16515

Construction of low-cost, Mod-OA wood composite wind turbine blades

[NASA-TM-83046] p 163 N83-16857

Design and evaluation of low-cost stainless steel fiberglass foam blades for large wind driven generating systems

[NASA-CR-165491] p 169 N83-19226

Low-cost composite blades for the Mod-OA wind turbines

p 170 N83-19242

Fiberglass composite blades for the 4 MW - WTS-4 wind turbine

p 170 N83-19243

Design and evaluation of low cost blades for large wind driven generating systems

p 170 N83-19244

Structural fatigue test results for large wind turbine blade sections

p 170 N83-19246

Stability analysis of flexible wind turbine blades using finite element method

[NASA-CR-168107] p 177 N83-21508

Comparison of model and observations of the wake of a MOD-OA wind turbine

[DE83-002882] p 180 N83-21633

TURBINE ENGINES

Turbine engine fuel conservation by fan and compressor profile control

p 12 N83-17467

Future of alternate fuels for turbine engines

p 141 N83-22453

TURBINES

Twenty years of experience with organic Rankine cycle turbines - Their applicability and use in energy conservation and alternative energy systems

p 3 A83-27207

Definition of cost-effective river-turbine designs

[DE82-010972] p 175 N83-20413

Status of DOE small hydropower research and development projects

[DE83-001353] p 125 N83-20434

TURBOCOMPRESSORS

18 1 pressure ratio axial/centrifugal compressor demonstration program

p 161 A83-29013

TURBOFAN ENGINES

PW 4000 - A radically new jet engine being developed in the USA

p 1 A83-23239

Energy efficient engine Fan test hardware detailed design report

[NASA-CR-165148] p 4 N83-16341

TURBOGENERATORS

On-site production of electrolytic hydrogen for generator cooling

p 86 A83-27209

A study of a solar central power plant with a gas turbine - Project Sirocco modelling and control --- French thesis

p 53 A83-28652

- Evaluation of deterioration due to hot creep in chrome-molybdenum ferritic steels used in thermal power stations
[BLL-CE-TRANS-7669-(9022 09)] p 162 N83-16470
- Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model
[DE83-004004] p 197 N83-22758
- TURBOMACHINERY**
Ceramic heat-exchanger applications study
[DE83-003166] p 132 N83-21529
- The investigation of passive blade cyclic pitch variation using an automatic yaw control system
[DE83-000651] p 178 N83-21548
- TURBULENT DIFFUSION**
Joint measurements of radial velocity and scalars in a turbulent diffusion flame p 86 A83-24365
- Using a global hydrogen-air combustion model in turbulent reacting flow calculations p 86 A83-24667
- TURBULENT FLOW**
Premixed, turbulent combustion of a sudden-expansion flow p 92 A83-23748
- Convective heat losses from flat-plate solar collectors in turbulent winds p 43 A83-23883
- Joint measurements of radial velocity and scalars in a turbulent diffusion flame p 86 A83-24365
- Using a global hydrogen-air combustion model in turbulent reacting flow calculations p 86 A83-24667
- A 2D model of turbulent solar induced flows in passive air collectors p 53 A83-29039
- The generation of electric currents by the turbulent flow of dielectric liquids I - Long pipes p 161 A83-29089
- TURBULENT MIXING**
Prediction of turbulent mixing in confined co-axial reacting jets p 91 A83-23191
- TURBULENT WAKES**
The effects of tower shadow on the dynamics of a horizontal-axis wind turbine p 160 A83-27869
- TWO DIMENSIONAL BOUNDARY LAYER**
Joule heating effects in MHD generator boundary layers p 161 A83-28956
- TWO DIMENSIONAL FLOW**
Premixed, turbulent combustion of a sudden-expansion flow p 92 A83-23748
- TWO PHASE FLOW**
A study on two-phase, two-component Stirling engine p 160 A83-27328
- Performance and stability of the mist-lift process for open-cycle OTEC
[DE82-010881] p 175 N83-20403
- Flow instability during direct steam generation in a line-focus solar-collector system
[DE82-012887] p 70 N83-20404
- Photovoltaic/thermal collector development program
[DE82-012572] p 71 N83-20416
- U**
- U.S.S.R.**
American technology transfer and Soviet energy planning
[GPO-97-481] p 26 N83-20373
- ULTRASONIC MACHINING**
Ultrasonically enhanced size reduction of coal
[DE82-008679] p 113 N83-18416
- ULTRASONIC TESTS**
Association-solvation characteristic of fuels and lubricating and hydraulic oils
[NASA-TM-76957] p 96 N83-16525
- ULTRAVIOLET FILTERS**
Optical measurements p 66 N83-19567
- ULTRAVIOLET PHOTOMETRY**
Optical measurements p 66 N83-19567
- UNDERGROUND STORAGE**
Factors affecting storage of compressed air in solution mined salt cavities p 191 A83-27311
- Site selection and characterization for an underground coal gasification test in Washington State Volume 2 Project details
[DE82-010948] p 19 N83-18117
- The Illinois State Geological Survey The next quarter century p 112 N83-18139
- Underground energy-storage program overview
[DE83-002059] p 198 N83-22806
- Geotechnical basis for underground energy storage in hard rock
[DE82-903307] p 198 N83-22836
- UNDERGROUND STRUCTURES**
Mass balance results for the Princeton 1 underground coal gasification field test
[DE82-005667] p 162 N83-16556
- Characterization and supporting research for in-situ coal-gasification research and development project plan
[DE83-000962] p 101 N83-16910

- Automation of the longwall mining system
[NASA-CR-169933] p 114 N83-19183
- Mine personnel locator and mine activity controller
[PB82-235979] p 200 N83-19315
- Underground Coal Gasification (UCG) gas to methanol and MTG-gasoline An economic and sensitivity study, task B
[DE83-004320] p 146 N83-22821
- UNDERGROUND TRANSMISSION LINES**
Environmental impacts of undergrounding high-voltage transmission Health and safety
[DE82-010108] p 186 N83-18102
- UNDERWATER ENGINEERING**
The non-Federal oceanographic community An overview
[NASA-CR-169802] p 102 N83-17414
- UNDERWATER PROPULSION**
Stored chemical energy propulsion system for underwater applications
[AIAA PAPER 81-1601] p 188 A83-23132
- UNDERWATER STRUCTURES**
Experience in testing of a solution mined storage cavern
[DE82-011013] p 113 N83-18464
- UNSTEADY FLOW**
High power pulsed plasma MHD experiments
[AD-A120526] p 176 N83-20781
- UPGRADING**
Fuel quality/processing study Volume 3 Fuel upgrading studies
[NASA-CR-165326-VOL-3] p 144 N83-22754
- URANIUM**
Survey of lands held for uranium exploration, development and production in fourteen western states for the six-month period ending June 30, 1981
[DE82-006228] p 99 N83-16838
- Uranium hydrogeochemical and stream sediment reconnaissance of the St Michael NTMS quadrangle, Alaska
[DE82-009999] p 99 N83-16844
- Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska
[DE82-009666] p 115 N83-19196
- Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197
- PLTSYM A FORTRAN computer system to plot Canadian symbol location maps for hydrogeochemical and stream-sediment reconnaissance data
[DE83-000764] p 123 N83-20337
- Energy resources in New Mexico Oil and gas, coal, electrical generation, uranium, and geothermal energy
[DE83-900485] p 142 N83-22672
- Uranium p 143 N83-22677
- URANIUM COMPOUNDS**
The uranyl ion, fluorescent and fluorone-like - A review
p 45 A83-26061
- URBAN DEVELOPMENT**
Annual Transportation Convention, volume 2 Session F Energy and Transportation Engineering Session G Transport Planning
[CSIR-S-313-VOL-2] p 37 N83-23212
- URBAN PLANNING**
Engineering the Future for the Benefit of Mankind, volume 2
[PB82-225491] p 24 N83-19634
- Analysis and design of residential load centers Volume 2 Appendices
[DE82-014253] p 24 N83-19956
- Putting renewable energy to work in cities
[DE82-016178] p 27 N83-20427
- Annual Transportation Convention, volume 2 Session F Energy and Transportation Engineering Session G Transport Planning
[CSIR-S-313-VOL-2] p 37 N83-23212
- URBAN TRANSPORTATION**
Program overview and diesel/flywheel hybrid power train design - Fibre composite flywheel development program for road vehicle applications p 190 A83-27306
- Annual Transportation Convention, volume 2 Session F Energy and Transportation Engineering Session G Transport Planning
[CSIR-S-313-VOL-2] p 37 N83-23212
- USER MANUALS (COMPUTER PROGRAMS)**
User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 1 Main text
[DE82-022512] p 99 N83-16865
- ASPEN technical reference manual
[DE82-020201] p 112 N83-18325
- ASPEN technical reference manual
[DE82-020200] p 112 N83-18326
- ASPEN system administrator manual
[DE82-202199] p 112 N83-18327

- ASPEN system administrator manual
[DE82-020198] p 113 N83-18328
- ASPEN user manual
[DE82-020196] p 113 N83-18329
- Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 2 User's manual for a computer program for 1-dimensional coal combustion or gasification (1-DICOG)
[DE82-015610] p 119 N83-19868
- Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 3 User's manual for a computer program for 2-Dimensional Coal Gasification or Combustion (PCGC-2)
[DE82-015611] p 119 N83-19869
- Transportation network models for energy supply analysis Volume 3 Transportation network model user's guide and documentation
[DE82-903079] p 187 N83-20400
- Gulf coast ecological inventory user's guide and information base
[DE83-900406] p 28 N83-20455
- Program listing for heat-pump Seasonal-Performance Model (SPM)
[DE83-002436] p 33 N83-21612
- User's manual for HDR3 computer code
[DE83-003993] p 136 N83-21828
- SHEBMS Small Hydroelectric Basin Modeling System
[DE82-015411] p 183 N83-22832
- USER REQUIREMENTS**
Thermal energy storage - Air Force user considerations in various modes of operation p 190 A83-27305
- UTILITIES**
Operating considerations in reliability of modelling of wind-assisted utility systems p 150 A83-22022
- Load following impacts of a large wind farm on an interconnected electric utility system
p 151 A83-22675
- Analysis of fixed-base flywheel systems for electric utility applications p 190 A83-27310
- Reversible chemical reactions for energy storage in a large-scale heat utility p 51 A83-27315
- Stochastic methods for analysis of power flow in electric networks
[DE83-000445] p 5 N83-16653
- Electric vehicles in electric utilities A national survey
[DE82-901285] p 5 N83-16655
- Energy projections to the year 2000, July 1982 update
[DE82-022523] p 5 N83-16870
- Development of advanced batteries for utility application
[DE82-906459] p 193 N83-16918
- Penetration for four solar technologies in electric utilities and the environmental benefits
[DE82-010864] p 59 N83-16927
- Compressed-air energy storage Preliminary design and site-development program in an aquifer Volume 3 Site-selection study, part 2
[DE83-001252] p 194 N83-18074
- Future analysis, forecasting and planning for telecommunications, energy and public utilities
[RAND-P-6796] p 20 N83-18978
- Mod-2 wind turbine project assessment and cluster test plans p 172 N83-19262
- An overview of large wind turbine tests by electric utilities p 172 N83-19265
- Utility experience with two demonstration wind turbine generators p 173 N83-19266
- Initial utility experience with cluster of three Mod-2 wind turbine systems p 173 N83-19268
- A review of utility issues for the integration of wind electric generators p 173 N83-19269
- Economics of wind energy for utilities p 116 N83-19270
- Conceptual design of the 7 megawatt Mod-5B wind turbine generator p 173 N83-19272
- Residential and commercial cogeneration systems assessment
[PB82-240037] p 22 N83-19314
- Solar electric technologies Methods of electric utility value analysis
[DE82-014285] p 71 N83-20409
- Coal p 143 N83-22675
- Issues affecting storage of compressed air in solution-mined salt cavities p 197 N83-22804
- Roadway-powered electric-vehicle project
[DE83-003147] p 184 N83-23243
- UTILIZATION**
Passive-Solar Commercial Buildings Program, 1980 - 1982
[DE82-012472] p 72 N83-21202

V

VACUUM

Polycrystalline solar cell/substrate growth by integrated vacuum evaporation
[DE82-017203] p 58 N83-16917

VACUUM PUMPS

Solar district heating with evacuated collectors First year experience of the Knivsta plant
[PB82-262114] p 59 N83-16939

VALUE ENGINEERING

Development of residential-conservation-survey methodology for the US Air Force Task 2
[DE82-009473] p 18 N83-18077

VAPOR DEPOSITION

High efficiency $p/n-n/p$ back-surface field silicon solar cells with very large short-circuit current densities p 41 A83-22913
Chemically vapor-deposited black molybdenum films of high IR reflectance and significant solar absorptance p 44 A83-25534
The growth of Zn₃P₂ by metalorganic chemical vapor deposition --- material for low cost photovoltaic devices p 45 A83-26065

VAPOR PHASE EPITAXY

Single and multijunction space solar cells grown by organometallic vapor phase epitaxy /OM-VPE/ p 50 A83-27260

VAPOR PHASES

Fuel-composition and -vaporization effects on combustion-chamber deposits p 104 A83-17670
FDAS hardware and firmware description, Liquefied Gaseous Fuels (LGF) data-acquisition system [DE82-012602] p 107 N83-17741
Theoretical studies of solar-pumped lasers [NASA-CR-169890] p 60 N83-17871
Flame acceleration mechanisms under conditions of partial confinement p 120 N83-19881 [PB83-109884]

VAPOR PRESSURE

Open-cycle vapor compression heat pump [PB82-262569] p 8 N83-16947

VAPORIZERS

A highly efficient collector for small solar energy installations p 60 N83-16948 [PB82-255191]

VAPORIZING

Chemical effects in vaporizing synthetic fuels [DE82-003352] p 96 N83-16549
Fuel-composition and -vaporization effects on combustion-chamber deposits p 104 A83-17670 [DE82-012576]
Vaporization thermodynamics of K₂S and K₂SO₃ [NASA-CR-168080] p 117 N83-19812
Review of alternative fuels data bases p 140 N83-22439 [NASA-CR-170203]

VAPORS

Ignition sources of LNG vapor clouds [PB82-262577] p 96 N83-16461

VEGETATION

Use of vegetation to ameliorate building microclimates An assessment of energy-conservation potentials [DE82-013255] p 32 N83-21572

VELOCITY MEASUREMENT

Velocity measurements in an axisymmetric laminar flow using an optical technique of visualization in coherent light p 54 A83-29704

VENTILATION

Strategies for energy conservation in small office buildings p 22 N83-19306 [PB82-245820]
Ventilated wall and window test passive-solar concept [DE83-900824] p 78 N83-21614
Residential air-to-air heat exchangers A study of the ventilation efficiencies of wall- or window-mounted units [DE83-004752] p 33 N83-21617

VERTICAL DISTRIBUTION

The influence of large-scale advection on the vertical distribution of stratospheric source gases in 44 degree and 41 degree north p 1 A83-20224
Aeroelastic stability and dynamic response analysis of the LDB-125 vertical axis wind turbine [FFA-TN-1982-19] p 167 N83-18028
Vertical extrapolations of wind speed [DE83-000944] p 136 N83-21723

VERTICAL ORIENTATION

Type-curve analysis of pressure buildup from vertically fractured wells in low permeability reservoirs [DE82-010513] p 115 N83-19198
ASI/Pinson 1-kilowatt high-reliability wind system development. Phase 1 Design and analysis [DE82-016128] p 180 N83-21602

VIBRATION EFFECTS

The results of an experimental investigation of the effect of vibration loading parameters on the working characteristics of heat pipes p 184 A83-23924

VIBRATION MEASUREMENT

Modal testing of a rotating wind turbine [DE83-003630] p 178 N83-21526

VIBRATION MODE

Modal testing of a rotating wind turbine [DE83-003630] p 178 N83-21526

VIBRATORY LOADS

The results of an experimental investigation of the effect of vibration loading parameters on the working characteristics of heat pipes p 184 A83-23924

VINYL POLYMERS

Industrial technology for economic and viable encapsulation for large solar panels p 59 N83-16936 [PB82-259839]

VISCOELASTICITY

Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery [DE82-008705] p 140 N83-22436

VISCOMETRY

Viscometric and misting properties of polymer-modified fuel [NASA-CR-169750] p 96 N83-16543

VISCOSITY

Linear oil displacement by the emulsion entrapment process [DE82-007751] p 99 N83-16841

VOLATILITY

Volatile production during preignition coil heating [DE82-011241] p 95 N83-16445
Rates and equilibria of devolatilization and trace element evolution in coal pyrolysis p 96 N83-16460 [PB82-260944]
Trends in motor gasolines, 1942 - 1981 [DE82-021124] p 96 N83-16550

VOLCANOLOGY

Preliminary geothermal evaluation of the Mokapu Peninsula on the island of Oahu, Hawaii [AD-A119158] p 117 N83-19378

VOLT-AMPERE CHARACTERISTICS

Molten carbonate fuel cell performance model p 149 A83-19884
Photoelectrochemical processes in bismuth germanium oxide, Bi₁₂GeO₂₀ single crystals p 38 A83-20581
Amorphous silicon - A new semiconductor material for solar cells p 39 A83-21627
Al-Si peaked Schottky barriers p 40 A83-22903
A semiconductor-insulator-semiconductor CdO-SiO₂-Si solar cell p 41 A83-22912
Distribution voltage for high-power satellites p 153 A83-27150
Factors affecting the efficiency of chemically deposited CdSe based photoelectrochemical cells p 54 A83-29514

VOLTAGE GENERATORS

Low power, air-cooled DC-Link aircraft generation systems p 159 A83-27324

VOLTAGE REGULATORS

High-efficiency spacecraft power conversion techniques p 45 A83-27135
Low power, air-cooled DC-Link aircraft generation systems p 159 A83-27324
Control design and performance analysis of a 6 MW wind turbine-generator p 162 A83-29897

VORTICES

Design of a vortex-flow solar chemical reactor [DE83-000031] p 58 N83-16914
Energy from humid air [DE82-017121] p 180 N83-21601
Comparison of model and observations of the wake of a MOD-OA wind turbine [DE83-002882] p 180 N83-21633

W

WAFERS

Minimum silicon wafer thickness for ID wafering p 41 A83-22924

WAKES

The wake of the MOD-OA1 wind turbine at two rotor diameters downwind on December 3, 1981 [DE83-003305] p 180 N83-21622

WALKING MACHINES

The use of mechanical energy storage in an unconventional, rough terrain vehicle p 190 A83-27309

WALL TEMPERATURE

Cross-sectional current distribution in coal fired diagonal conducting wall MHD generator p 151 A83-23130
MHD channel electrical boundary-layer theory and applications p 151 A83-23131

WALLS

Ventilated wall and window test passive-solar concept [DE83-900824] p 78 N83-21614

WASHINGTON

Site selection and characterization for an underground coal gasification test in Washington State Volume 2 Project details [DE82-010948] p 19 N83-18117
Low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington [DE83-001433] p 145 N83-22789

WASTE DISPOSAL

A preliminary study of environmental parameters associated with the feasibility of a polygeneration plant at Kennedy Space Center p 11 N83-17365
A brief overview of geophysical probing technology [DE82-011217] p 19 N83-18133
The Illinois State Geological Survey The next quarter century p 112 N83-18139
Geotechnical properties of PARAHQ spent shale [DE83-002633] p 136 N83-21694

WASTE ENERGY UTILIZATION

A wind-diesel energy system for Grimsey, Iceland p 150 A83-22021
Twenty years of experience with organic Rankine cycle turbines - Their applicability and use in energy conservation and alternative energy systems p 3 A83-27207
Evaluation of industrial advanced heat recovery/thermal energy storage systems [DE82-906475] p 193 N83-16919
Biomass cogeneration A business assessment [DE82-011773] p 101 N83-16928
Heating of domestic water by waste heat recovery from household refrigerating equipment [BMFT-FB-T-82-156] p 7 N83-16930
HYFIRE A Tokamak/high-temperature electrolysis system [DE82-004806] p 88 N83-17323
Steam ejector as an industrial heat pump [DE82-010194] p 14 N83-17847
Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 1 [BMFT-FB-T-82-151-VOL-1] p 15 N83-18026
Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 2 [BMFT-FB-T-82-151-VOL-2] p 15 N83-18027
Potential for domestic heat recovery [DE82-901395] p 15 N83-18037
Opportunities for direct-contact waste heat recuperators for industrial heat recovery [DE82-006280] p 15 N83-18038
Flow distribution control characteristics in marine gas turbine waste-heat recovery system Phase 2 Flow distribution control in waste-heat steam generators [AD-A119310] p 175 N83-20054
Conceptual design and performance analysis of absorption heat pumps for waste-heat utilization [DE82-010202] p 186 N83-20060
Applications guide for waste heat recovery [NASA-CR-170121] p 178 N83-21511
Design and component testing of a low-temperature waste-heat-driven refrigeration system, phases 1 and 2 [DE82-014721] p 179 N83-21571
Energy recovery and cogeneration from an existing municipal incinerator Phase 2A Final design [DE82-007911] p 179 N83-21577

WASTE HEAT

Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 1 [BMFT-FB-T-82-151-VOL-1] p 15 N83-18026
Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 2 [BMFT-FB-T-82-151-VOL-2] p 15 N83-18027
Potential for domestic heat recovery [DE82-901395] p 15 N83-18037
Opportunities for direct-contact waste heat recuperators for industrial heat recovery [DE82-006280] p 15 N83-18038

WASTE TREATMENT

Municipal-solid-waste biconversion technologies [DE83-000263] p 100 N83-16893
H-Coal Pilot Plant. Phase 2 Construction and Phase 3 Operation [DE82-005117] p 106 N83-17732
Methane from landfills Preliminary assessment workbook [DE83-002319] p 111 N83-18075
Feasibility of applications of microwave technology for nuclear power plant radioactive wastes [DE82-903143] p 29 N83-20744

WASTE UTILIZATION

- Landfill gas to electricity demonstration project
[PB82-255290] p 7 N83-16943
- Methane from landfills Preliminary assessment
workbook
[DE83-002319] p 111 N83-18075
- Gasification of land-based biomass
[PB83-109918] p 122 N83-19946
- Bi-state solid-waste-to-energy project
[DE83-004458] p 28 N83-20435
- Waste lubricating oil An annotated review, 1982
revision
[DE83-001439] p 30 N83-21156
- Oil/refuse homogenization An approach to combustion
of refuse in existing oil-fired boilers
[DE82-011848] p 138 N83-22353
- Development and demonstration of a reverse-osmosis
energy-recovery device
[PB83-108605] p 140 N83-22380
- State of California Resource-recovery profile
[DE83-004949] p 146 N83-22812

WASTE WATER

- Flue gas desulfurization with waste water evaporation
Phase 2 Observation of the experiments at Weiher II
[BMFT-FB-T-82-026] p 125 N83-21053

WASTES

- Air traffic control Its effect on fuel conservation
p 12 N83-17464

WATER

- Present status of R&D for hydrogen production from
water in Japan p 86 A83-23701
- Current research in advanced water electrolysis in the
United States and abroad p 87 A83-27216
- Experimental techniques for the study of photosynthetic
water splitting
[DE82-003974] p 89 N83-17668
- Further development and evaluation of coal-water
mixture technology
[DE82-010518] p 106 N83-17736
- Evaluation of production version of the NASA improved
inorganic-organic separator
[NASA-TM-83018] p 166 N83-18022
- Study based on ammonia/water solutions of a distinct
heating transport system
[BMFT-FB-T-82-188] p 186 N83-18033
- Performance simulation of the JPL solar-powered
distiller Part 1 Quasi-steady-state conditions --- for
cooling microwave equipment p 66 N83-19781
- Transport characteristics of alternate slurry fuels
[DE82-013508] p 121 N83-19939
- Utilization of warm well water, eastern Washington
state
[DE82-015101] p 134 N83-21594

WATER HEATING

- Transient analysis of a natural circulation solar water
heater with a heat exchanger p 41 A83-23129
- Transient characteristics of flat-plate solar collector
p 42 A83-23333
- Bellingham Phase 3, Engineering and technology
development for a hot-water district-heating system
employing thermal-energy storage
[DE82-000106] p 192 N83-16862
- Electric system impacts of storage heating and storage
water heating, part 2
[DE81-032010] p 192 N83-16863
- Comparative report Performance of solar hot-water
systems, 1980 - 1981 p 56 N83-16889
- Heating of domestic water by waste heat recovery from
household refrigerating equipment
[BMFT-FB-T-82-156] p 7 N83-16930
- Economic evaluation of solar energy systems in
commercial buildings Methodology and case studies
[PB82-260456] p 165 N83-16938
- Solar energy plant as a complement to a conventional
heating system Measurement of the storage and
consumption of solar energy
[PB82-255209] p 59 N83-16946
- Comparison of heat pump water heaters and solar
domestic water heaters p 61 N83-18046
- Helio-Thermics, Inc., lot no 8, single family residence,
Greenville, South Carolina
[DE82-012822] p 65 N83-19283
- Performance evaluation manual for submetered data
collection
[DE82-011223] p 70 N83-20402
- Intermediate photovoltaic system application experiment
operational performance report Volume 2 G N Wilcox
Memorial Hospital, Kauai, Hawaii p 74 N83-21541
- Integrated solar heating, cooling, and hot-water system
for University City High School, San Diego, California
[DE82-020993] p 75 N83-21555

Geothermal heating facilities for Frontier Inn, Susanville,
California

- [DE82-015114] p 134 N83-21590
- Design approaches for solar industrial process-heat
systems Nontracking and line-focus collector
technologies
[DE83-003339] p 79 N83-21620
- Performance and economics of 8 alternative systems
for residential heating, cooling, and water heating in 115
US cities
[DE83-003196] p 33 N83-21630
- Reliability and design guidelines for combined
solar-space-heating and domestic hot-water system
[DE83-003341] p 79 N83-21635
- Development of an advanced solar augmented water
heater (for single family home applications)
[PB83-119610] p 84 N83-22842

WATER INJECTION

- Coaling polymer demonstration project
[DE82-007019] p 105 N83-17726

WATER MANAGEMENT

- Engineering the Future for the Benefit of Mankind,
volume 2
[PB82-225491] p 24 N83-19634
- Role of water in energy development
[DE82-011986] p 35 N83-22800

WATER POLLUTION

- Chemical characterization of organic contaminants in
groundwater near an underground coal gasification site
[DE82-004822] p 8 N83-16956
- Development of statistical databases for toxicological
studies
[DE82-005196] p 10 N83-17067
- Dissolved methane concentrations in the southeast
Bering Sea, 1980 and 1981
[PB83-112433] p 29 N83-20525

WATER QUALITY

- A preliminary study of environmental parameters
associated with the feasibility of a polygeneration plant
at Kennedy Space Center p 11 N83-17365
- Western oil-shale development, a technology
assessment Volume 6 Oil-shale development in the
Piceance Creek Basin and potential water-quality
changes
[DE82-005659] p 108 N83-18009

WATER RESOURCES

- Two level multi-objective reconnaissance system study
of a large water resource system
[PB82-239716] p 20 N83-19213
- Modeling water supply for the energy sector
p 25 N83-20336
- Cartographic evaluation of environmental-management
strategies
[DE82-009828] p 35 N83-22702
- Role of water in energy development
[DE82-011986] p 35 N83-22800

WATER TREATMENT

- Identification and removal of the organic compounds
in coal-conversion condensate waters
[DE82-004825] p 8 N83-16955
- Cleanup of groundwater contaminated by underground
coal gasification
[DE82-005824] p 19 N83-18118

WATER WAVES

- Wave model A numerical model for the frictional
absorption of water waves
[PB83-100792] p 122 N83-20073

WATER WHEELS

- Present and potential use of micro-hydroelectric
schemes in remote locations
[DE82-904687] p 26 N83-20411

WATERWAY ENERGY

- International Conference on Future Energy Concepts,
3rd, London, England, January 27-30, 1981, Proceedings
p 199 A83-24975

WATERWAY ENERGY CONVERSION

- Marine power - Accomplishments of the 1970s
p 155 A83-27223

WEAR TESTS

- Emulsified fuel testing in a medium speed diesel
engine
[PB82-250697] p 98 N83-16564

WEATHER

- Intermediate photovoltaic system application experiment
operational performance report Volume 1 G N Wilcox
Memorial Hospital, Kauai, Hawaii
[DE83-000393] p 57 N83-16897
- Intermediate photovoltaic system application experiment
operational performance report Volume 5 For CDC Light
Manufacturing Building, San Bernardino, California, for July
1982
[DE83-003801] p 73 N83-21517
- Intermediate photovoltaic system application experiment
operational performance report for CDC Light
Manufacturing Building, San Bernardino, California
[DE83-002529] p 78 N83-21605

Intermediate photovoltaic system application experiment
operational performance report for Oklahoma Center for
Science and Arts for June, July, and August 1982

- [DE83-003668] p 78 N83-21606
- September 1982 environmental data for sites in the
National Solar Data Network
[DE83-001839] p 80 N83-21722
- Intermediate photovoltaic system application experiment
operational performance report Volume 1 Dallas - Fort
Worth Regional Airport, Texas, July 1982
[DE83-004763] p 84 N83-22819

WEBS (SHEETS)

- Advanced silicon-sheet-growth techniques
[DE82-017088] p 84 N83-22831

WEIGHT REDUCTION

- Review and evaluation of automotive fuel conservation
technologies
[PB83-101139] p 30 N83-20844

WELED JOINTS

- Thermal fatigue tests of Solar One receiver-tube
weldments
[DE82-012520] p 81 N83-22599

WELED STRUCTURES

- Advanced cell designs for welded arrays
p 50 A83-27257

WELDING

- US welding technology - Constraints to space
implementation --- for solar arrays p 49 A83-27249
- Development of technologies for welding interconnects
to fifty-micron thick silicon solar cells
[NASA-CR-170212] p 81 N83-22742

WELLS

- Reservoir engineering transient pressure well testing,
and petrophysical analyses of western gas sands
[DE82-004879] p 99 N83-16839
- Devonian shale extraction test wells
[DOE/MC-08386/T1] p 108 N83-18013
- Technologies for Measurement While Drilling
[PB82-243858] p 114 N83-18964
- Type-curve analysis of pressure buildup from vertically
fractured wells in low permeability reservoirs
[DE82-010513] p 115 N83-19198
- Monitoring well systems in geothermal areas
[DE82-012770] p 133 N83-21586
- Utilization of warm well water, eastern Washington
state
[DE82-015101] p 134 N83-21594
- Use of twin wells and water-source heat pumps for
energy conservation in Louisiana
[DE83-900349] p 32 N83-21610
- Colorado geothermal resource assessment Shallow-hole
temperature survey Intermediate-depth holes IGH no 1
and no 2, Depth test hole 44X-10
[DE83-002898] p 135 N83-21621

WEST VIRGINIA

- Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703

WILDLIFE

- Gulf coast ecological inventory user's guide and
information base
[DE83-900406] p 28 N83-20455
- Future landscapes of the Colorado plateau Impacts
of energy development
[DE83-900473] p 34 N83-21666

WIND (METEOROLOGY)

- The Wind Characteristics Program
[DE82-005226] p 101 N83-17023
- Large Horizontal-Axis Wind Turbines
[NASA-CP-2230] p 169 N83-19231
- Approaches to wind resource verification
p 116 N83-19238

WIND DIRECTION

- The useful potential of using existing data to uniquely
identify predictable wind events and regimes, part 1
p 116 N83-19250

- The useful potential of using existing data to uniquely
identify predictable wind events and regimes, part 2
p 116 N83-19251

WIND EFFECTS

- General review of wind engineering problems
p 114 N83-18944

WIND MEASUREMENT

- World-wide resource assessment
[DE82-004272] p 102 N83-17024
- Environmental data for sites in the National Solar Data
Network
[DE82-007055] p 64 N83-19280
- Coastal zone wind energy Part 3 A procedure to
determine the wind power potential of the coastal zone
[DE82-014334] p 134 N83-21598

WIND PROFILES

- Current aspects of wind-energy utilization - Status and
prospects in Bulgaria --- wind resources and site selection
for industrial applications p 91 A83-22421
- A practical economic criterion for fuel conservation
p 12 N83-17468

- Vertical extrapolations of wind speed
[DE83-000944] p 136 N83-21723
- WIND SHEAR**
Anti-misting additives for jet fuels
[NASA-CR-169751] p 94 N83-16417
- WIND TUNNEL APPARATUS**
Force inductions in helicopter rotor blades, wind channel fans and wind turbines
[MBB-UD-356-82-O] p 166 N83-17522
- WIND TUNNEL TESTS**
Aerodynamic tests of Darneus wind turbine blades
p 151 A83-23128
- WIND TUNNELS**
Renewable energy system feasibility study
[AD-A121252] p 15 N83-18035
- WIND TURBINES**
Wind characteristics in Southern Wyoming
p 150 A83-20802
Numerical determination of the configuration of a rotating blade with constant stress --- for vertical axis wind turbines
p 150 A83-22020
Aerodynamic tests of Darneus wind turbine blades
p 151 A83-23128
Advances in wind energy technology
[DGLR PAPER 82-082] p 151 A83-24194
Problem solution areas related to the implementation of the large wind turbine Voith WEC 520
[DGLR PAPER 82-083] p 152 A83-24195
Stability and response characteristics of one- and two-blade wind turbines
[DGLR PAPER 82-084] p 152 A83-24196
Electricity from wind - A survey of the state of the art and future prospects for research and development
[DGLR PAPER 82-081] p 152 A83-24202
Control design for a wind turbine-generator using output feedback
p 152 A83-24721
Size effects in DAWT innovative wind energy system design
[ASME PAPER 82-WA/SOL-20] p 153 A83-25688
Development of the WTS-4 wind turbine design
p 159 A83-27323
The environmental impact of the use of large wind turbines
p 4 A83-27867
Augmentation of power in slow-running vertical-axis wind rotors using multiple vanes
p 160 A83-27868
The effects of tower shadow on the dynamics of a horizontal-axis wind turbine
p 160 A83-27869
Mathematical programming models for the economic design and assessment of wind energy conversion systems
p 161 A83-27870
Proposal for a new design of wind power generator
p 161 A83-27871
Control design and performance analysis of a 6 MW wind turbine-generator
p 162 A83-29897
Construction, testing and development of large wind energy facilities
[NASA-TM-76933] p 163 N83-16855
Construction of low-cost, Mod-OA wood composite wind turbine blades
[NASA-TM-83046] p 163 N83-16857
The MOD-OA 200 kilowatt wind turbine generator design and analysis report
[NASA-CR-165127] p 163 N83-16859
Candidate wind-turbine-generator site summarized meteorological data for the period December 1976 through December 1981
p 102 N83-17028
Force inductions in helicopter rotor blades, wind channel fans and wind turbines
[MBB-UD-356-82-O] p 166 N83-17522
Aeroelastic stability and dynamic response analysis of the LDB-125 vertical axis wind turbine
[FFA-TN-1982-19] p 167 N83-18028
Design and evaluation of low-cost stainless steel fiberglass foam blades for large wind driven generating systems
[NASA-CR-165491] p 169 N83-19226
Large Horizontal-Axis Wind Turbines
[NASA-CP-2230] p 169 N83-19231
The response of a 38m horizontal axis teetered rotor to yaw
p 169 N83-19232
Fixed pitch rotor performance of large horizontal axis wind turbines
p 169 N83-19233
Stall induced instability of a teetered rotor
p 169 N83-19234
Free yaw performance of the Mod-O large horizontal axis 100 kW wind turbine
p 170 N83-19235
Multiple and variable speed electrical generator systems for large wind turbines
p 170 N83-19236
Putting wind resource atlases to use
p 115 N83-19237
Approaches to wind resource verification
p 116 N83-19238
Assessing the representativeness of wind data for wind turbine site evaluation
p 116 N83-19239
- Wind turbine siting A summary of the state of the art
p 116 N83-19240
Fiberglass composite blades for the 2 MW Mod-1 wind turbine generator
p 170 N83-19241
Low-cost composite blades for the Mod-OA wind turbines
p 170 N83-19242
Fiberglass composite blades for the 4 MW - WTS-4 wind turbine
p 170 N83-19243
Design and evaluation of low cost blades for large wind driven generating systems
p 170 N83-19244
Structural fatigue test results for large wind turbine blade sections
p 170 N83-19246
Wind and turbine characteristics needed for integration of wind turbine arrays into a utility system
p 171 N83-19247
Long-term energy capture and the effects of optimizing wind turbine operating strategies
p 171 N83-19248
Integration of Wind Turbine Generation (WTG) into utility generating systems
p 171 N83-19249
Atmospheric turbulence parameters for modeling wind turbine dynamics
p 171 N83-19252
Inherent uncertainties in meteorological parameters for wind turbine design
p 171 N83-19253
Potential errors in using one anemometer to characterize the wind power over an entire rotor disk
p 171 N83-19254
Performance and load data from Mod-OA and Mod-1 wind turbine generators
p 171 N83-19255
Operating experience with four 200 kW Mod-OA wind turbine generators
p 171 N83-19256
Experience and assessment of the DOE/NASA Mod-1 2000 kW wind turbine generator at Boone, North Carolina
p 172 N83-19257
Description of the 3 MW SWT-3 wind turbine at San Geronimo Pass, California
p 172 N83-19258
Operational experience on the MP-200 series commercial wind turbine generators
p 172 N83-19259
Development tests for the 2.5 megawatt Mod-2 wind turbine generator
p 172 N83-19260
Test status and experience with the 7.5 megawatt Mod-2 wind turbine cluster
p 172 N83-19261
Mod-2 wind turbine project assessment and cluster test plans
p 172 N83-19262
Status of the 4 MW WTS-4 wind turbine
p 172 N83-19263
The 80 megawatt wind power project at Kahuku Point, Hawaii
p 172 N83-19264
An overview of large wind turbine tests by electric utilities
p 172 N83-19265
Utility experience with two demonstration wind turbine generators
p 173 N83-19266
WTS-4 system verification unit for wind/hydroelectric integration study
p 173 N83-19267
Initial utility experience with cluster of three Mod-2 wind turbine systems
p 173 N83-19268
A review of utility issues for the integration of wind electric generators
p 173 N83-19269
Economics of wind energy for utilities
p 116 N83-19270
Conceptual design of the 6 MW Mod-5A wind turbine generator
p 173 N83-19271
Conceptual design of the 7 megawatt Mod-5B wind turbine generator
p 173 N83-19272
Meteorological field measurements at potential and actual wind-turbine sites
[DE83-001493] p 174 N83-19398
Stability analysis of flexible wind turbine blades using finite element method
[NASA-CR-168107] p 177 N83-21508
Simplified aeroelastic modeling of horizontal axis wind turbines
[NASA-CR-168109] p 178 N83-21509
Modal testing of a rotating wind turbine
[DE83-003630] p 178 N83-21526
ASI/Pinson 1-kilowatt high-reliability wind system development. Phase 1 Design and analysis
[DE82-016128] p 180 N83-21602
Finite-element analysis and modal testing of a rotating wind turbine
[DE83-002609] p 180 N83-21608
The wake of the MOD-OA1 wind turbine at two rotor diameters downwind on December 3, 1981
[DE83-003305] p 180 N83-21622
Comparison of model and observations of the wake of a MOD-OA wind turbine
[DE83-002882] p 180 N83-21633
Some experiments on Yaw stability of wind turbines with various coning angles
[NASA-CR-168108] p 181 N83-22740
Fatigue testing of low-cost fiberglass composite wind turbine blade materials
[NASA-CR-165566] p 181 N83-22746
Development of methodology for horizontal axis wind turbine dynamic analysis
[NASA-CR-168110] p 181 N83-22747
- Production costing of an Advanced/Innovative Wind Energy Concept (AIWEC) Extension of the SAMICS methodology
[DE83-003085] p 182 N83-22783
- WIND VANES**
Development of an oscillating-vane concept as an innovative wind-energy-conversion system
[DE82-012870] p 179 N83-21599
- WIND VARIATIONS**
Spectra over complex terrain in the surface layer
[DE83-000502] p 102 N83-17027
Inherent uncertainties in meteorological parameters for wind turbine design
p 171 N83-19253
Potential errors in using one anemometer to characterize the wind power over an entire rotor disk
p 171 N83-19254
- WIND VELOCITY**
Simulation of wind-speed time series for wind-energy conversion analysis
[DE83-000043] p 165 N83-17026
Spectra over complex terrain in the surface layer
[DE83-000502] p 102 N83-17027
Wind and turbine characteristics needed for integration of wind turbine arrays into a utility system
p 171 N83-19247
The useful potential of using existing data to uniquely identify predictable wind events and regimes, part 1
p 116 N83-19250
The useful potential of using existing data to uniquely identify predictable wind events and regimes, part 2
p 116 N83-19251
Vertical extrapolations of wind speed
[DE83-000944] p 136 N83-21723
- WIND VELOCITY MEASUREMENT**
Wind characteristics in Southern Wyoming
p 150 A83-20802
Potential errors in using one anemometer to characterize the wind power over an entire rotor disk
p 171 N83-19254
Comparison of model and observations of the wake of a MOD-OA wind turbine
[DE83-002882] p 180 N83-21633
- WINDING**
Parametric investigations and other related studies of energy storage type capacitors
[DE83-003426] p 197 N83-22785
- WINDMILLS (WINDPOWERED MACHINES)**
On aerodynamic design of the Savonius windmill rotor
p 160 A83-27325
Workshop on the Federal Role in the Commercialization of Large Scale Windmill Technology (summary and papers)
[PB83-105593] p 28 N83-20438
Production costing of an Advanced/Innovative Wind Energy Concept (AIWEC) Extension of the SAMICS methodology
[DE83-003085] p 182 N83-22783
- WINDOWS**
Ventilated wall and window test passive-solar concept
[DE83-900824] p 78 N83-21614
- WINDOWS (APERTURES)**
Exterior insulating shutter final prototype design
[DE83-004520] p 33 N83-21616
- WINDPOWER UTILIZATION**
Wind characteristics in Southern Wyoming
p 150 A83-20802
A wind-diesel energy system for Gnmsey, Iceland
p 150 A83-22021
Operating considerations in reliability of modelling of wind-assisted utility systems
p 150 A83-22022
Current aspects of wind-energy utilization - Status and prospects in Bulgaria --- wind resources and site selection for industrial applications
p 91 A83-22421
Aerodynamic tests of Darneus wind turbine blades
p 151 A83-23128
Advances in wind energy technology
[DGLR PAPER 82-082] p 151 A83-24194
Problem solution areas related to the implementation of the large wind turbine Voith WEC 520
[DGLR PAPER 82-083] p 152 A83-24195
Stability and response characteristics of one- and two-blade wind turbines
[DGLR PAPER 82-084] p 152 A83-24196
International Conference on Future Energy Concepts, 3rd, London, England, January 27-30, 1981, Proceedings
p 199 A83-24975
Manne power - Accomplishments of the 1970s
p 155 A83-27223
R and D of energy saving and new energy utilization in Japanese manne engineering
p 4 A83-27225
The environmental impact of the use of large wind turbines
p 4 A83-27867
The effects of tower shadow on the dynamics of a horizontal-axis wind turbine
p 160 A83-27869

Mathematical programming models for the economic design and assessment of wind energy conversion systems p 161 A83-27870
 Proposal for a new design of wind power generator p 161 A83-27871
 Construction, testing and development of large wind energy facilities p 163 N83-16855
 [NASA-TM-78933]
 The MOD-OA 200 kilowatt wind turbine generator design and analysis report p 163 N83-16859
 [NASA-CR-165127]
 Wind system value analysis for electric utilities A comparison of four methods p 164 N83-16883
 [DE82-006963]
 Security assessment of power systems including energy storage and with the integration of wind energy Volume 1 Digital transient simulation effort consulting agreement number 1 p 164 N83-16915
 [DE82-021063]
 An assessment of wind characteristics and wind energy conversion systems for electric utilities p 165 N83-16935
 [PB82-258971]
 Penetration and air-emission-reduction benefits of solar technologies in the electric utilities p 9 N83-16971
 [DE82-002637]
 The Wind Characteristics Program p 101 N83-17023
 [DE82-005226]
 World-wide resource assessment p 102 N83-17024
 [DE82-004272]
 Simulation of wind-speed time series for wind-energy conversion analysis p 165 N83-17026
 [DE83-000043]
 Spectra over complex terrain in the surface layer p 102 N83-17027
 [DE83-000502]
 Candidate wind-turbine-generator site summarized meteorological data for the period December 1976 through December 1981 p 102 N83-17028
 [DE83-000884]
 ARLIS 1.0 Linear investigation of aerelastic systems in rotation p 166 N83-17905
 [ISD-293]
 Linear static and dynamic analysis for hinged rotor blades of 60 m span for a two bladed horizontal axis wind energy converter p 167 N83-18030
 [ISD-291]
 Renewable energy system feasibility study p 15 N83-18035
 [AD-A121252]
 Hybrid solar-wind energy conversion systems meteorological aspects p 61 N83-18053
 [DE82-005798]
 Design and standardization of meteorological measurements for wind energy converting systems p 168 N83-18172
 [BMFT-FB-T-82-168]
 Putting wind resource atlases to use p 115 N83-19237
 Approaches to wind resource verification p 116 N83-19238
 Assessing the representativeness of wind data for wind turbine site evaluation p 116 N83-19239
 Wind turbine siting A summary of the state of the art p 116 N83-19240
 Long-term energy capture and the effects of optimizing wind turbine operating strategies p 171 N83-19248
 Integration of Wind Turbine Generation (WTG) into utility generating systems p 171 N83-19249
 The useful potential of using existing data to uniquely identify predictable wind events and regimes, part 1 p 116 N83-19250
 The useful potential of using existing data to uniquely identify predictable wind events and regimes, part 2 p 116 N83-19251
 Mod-2 wind turbine project assessment and cluster test plans p 172 N83-19262
 The 80 megawatt wind power project at Kahuku Point, Hawaii p 172 N83-19264
 An overview of large wind turbine tests by electric utilities p 172 N83-19265
 Utility experience with two demonstration wind turbine generators p 173 N83-19266
 WTS-4 system verification unit for wind/hydroelectric integration study p 173 N83-19267
 Initial utility experience with cluster of three Mod-2 wind turbine systems p 173 N83-19268
 A review of utility issues for the integration of wind electric generators p 173 N83-19269
 Economics of wind energy for utilities p 116 N83-19270
 Demonstration of a solar/wind-powered electrostatic-field food-keeping device p 65 N83-19285
 [DE82-007971]
 Workshop on the Federal Role in the Commercialization of Large Scale Windmill Technology (summary and papers) p 28 N83-20438
 [PB83-105593]

Federal applications for wind energy systems A subcontract report p 31 N83-21543
 [DE83-000306]
 Electric-utility value determination for wind energy Volume 2 A user's guide p 134 N83-21596
 [DE82-010926]
 The acquisition of wind rights for wind energy development p 32 N83-21597
 [DE82-009139]
 Coastal zone wind energy Part 3 A procedure to determine the wind power potential of the coastal zone p 134 N83-21598
 [DE82-014334]
 Development of an oscillating-vane concept as an innovative wind-energy-conversion system p 179 N83-21599
 [DE82-012870]
 Vertical extrapolations of wind speed p 136 N83-21723
 [DE83-000944]
 Production costing of an Advanced/Innovative Wind Energy Concept (AIWEC) Extension of the SAMICS methodology p 182 N83-22783
 [DE83-003085]
WINDPOWER GENERATORS
 Load following impacts of a large wind farm on an interconnected electric utility system p 151 A83-22675
 Control design for a wind turbine-generator using output feedback p 152 A83-24721
 Control design and performance analysis of a 6 MW wind turbine-generator p 162 A83-29897
 The MOD-OA 200 kilowatt wind turbine generator design and analysis report p 163 N83-16859
 [NASA-CR-165127]
 An assessment of wind characteristics and wind energy conversion systems for electric utilities p 165 N83-16935
 [PB82-258971]
 Design and evaluation of low-cost stainless steel fiberglass foam blades for large wind driven generating systems p 169 N83-19226
 [NASA-CR-165491]
 Large Horizontal-Axis Wind Turbines p 169 N83-19231
 [NASA-CP-2230]
 The response of a 38m horizontal axis teetered rotor to yaw p 169 N83-19232
 Fixed pitch rotor performance of large horizontal axis wind turbines p 169 N83-19233
 Stall induced instability of a teetered rotor p 169 N83-19234
 Free yaw performance of the Mod-0 large horizontal axis 100 kW wind turbine p 170 N83-19235
 Multiple and variable speed electrical generator systems for large wind turbines p 170 N83-19236
 Putting wind resource atlases to use p 115 N83-19237
 Approaches to wind resource verification p 116 N83-19238
 Assessing the representativeness of wind data for wind turbine site evaluation p 116 N83-19239
 Wind turbine siting A summary of the state of the art p 116 N83-19240
 Fiberglass composite blades for the 2 MW Mod-1 wind turbine generator p 170 N83-19241
 Wind and turbine characteristics needed for integration of wind turbine arrays into a utility system p 171 N83-19247
 Integration of Wind Turbine Generation (WTG) into utility generating systems p 171 N83-19249
 Performance and load data from Mod-0A and Mod-1 wind turbine generators p 171 N83-19255
 Operating experience with four 200 kW Mod-0A wind turbine generators p 171 N83-19256
 Experience and assessment of the DOE/NASA Mod-1 2000 kW wind turbine generator at Boone, North Carolina p 172 N83-19257
 Description of the 3 MW SWT-3 wind turbine at San Geronio Pass, California p 172 N83-19258
 Operational experience on the MP-200 series commercial wind turbine generators p 172 N83-19259
 Development tests for the 2.5 megawatt Mod-2 wind turbine generator p 172 N83-19260
 Test status and experience with the 7.5 megawatt Mod-2 wind turbine cluster p 172 N83-19261
 The 80 megawatt wind power project at Kahuku Point, Hawaii p 172 N83-19264
 Utility experience with two demonstration wind turbine generators p 173 N83-19266
 A review of utility issues for the integration of wind electric generators p 173 N83-19269
 Conceptual design of the 7 megawatt Mod-5B wind turbine generator p 173 N83-19272
WIND OSCILLATIONS
 Development of an oscillating-vane concept as an innovative wind-energy-conversion system p 179 N83-21599
 [DE82-012870]

WIRING
 Photovoltaic subsystem optimization and design tradeoff study p 69 N83-20392
 [DE82-013393]
WISCONSIN
 Wisconsin collector-efficiency study, phase two p 71 N83-20426
 [DE82-013425]
WOOD
 Steam gasification of wood in the presence of catalysts p 162 N83-16557
 [DE82-005919]
 Methanol synthesis gas from catalytic steam reforming of wood p 106 N83-17734
 [DE82-006082]
 Catalyst behavior in biomass gasification --- wood p 110 N83-18057
 [DE82-006164]
 Direct liquefaction of biomass Results from operation of continuous bench scale unit in liquefaction of water slurries of Douglas fir wood p 124 N83-20414
 [DE82-015703]
 A technology assessment of solar energy systems Direct combustion of wood and other biomass in industrial boilers p 31 N83-21538
 [DE83-000937]
 Flash pyrolysis of biomass with reactive and non-reactive gases p 137 N83-22336
 [DE83-001850]
 Converting small industrial boilers to burn wood fuels p 147 N83-22844
 [PB83-128116]
WORK CAPACITY
 A physiological and hygienic evaluation of the work regime of operators who are working in current energy production in Georgia p 4 A83-28765
WORKING FLUIDS
 Numerical calculation of the heat transfer by natural convection in a cubical enclosure p 42 A83-23212
 Further development of the fluidyne liquid-piston engine p 156 A83-27275
 Performance characteristics of wet and dry fluidynes --- Stirling cycle engines p 156 A83-27278
 Design of hydraulic output unit for 15 kW free-piston Stirling engine p 157 A83-27277
 A study on two-phase, two-component Stirling engine p 160 A83-27328
 The multiple layer solar collector p 53 A83-28940
 Analyses of mixed hydrocarbon binary thermodynamic cycles for moderate temperature geothermal resources [DE82-006272] p 164 N83-16904
 Heat pipes containing alkali metal working fluid [NASA-CASE-LEW-12253-1] p 186 N83-19596
 Thermal-convective-loop correction tests of 316SS and IN800 in molten nitrate salts p 66 N83-19898
 [DE82-012313]
WRENCHES
 A study of bolting problems, tools, and practices in the nuclear industry p 168 N83-19099
 [DE82-902203]
WYOMING
 Wind characteristics in Southern Wyoming p 150 A83-20802
 The HFEM monitoring of coal gasification Rawlins, Wyoming p 142 N83-22466
 [DE82-013801]

X

X RAY FLUORESCENCE
 Application of energy dispersive X-ray fluorescence, ion sensitive electrodes and instrumental neutron activation in geochemical prospecting p 111 N83-18123
 [BMFT-FB-T-82-152]
XENON LAMPS
 The simulation of global radiation p 37 A83-20139

Y

YAW
 The response of a 38m horizontal axis teetered rotor to yaw p 169 N83-19232
 Free yaw performance of the Mod-0 large horizontal axis 100 kW wind turbine p 170 N83-19235
YAWING MOMENTS
 Some experiments on Yaw stability of wind turbines with various coning angles p 181 N83-22740
 [NASA-CR-168108]
 Development of methodology for horizontal axis wind turbine dynamic analysis p 181 N83-22747
 [NASA-CR-168110]

Z

ZINC

Health and environmental effects document for
batteries, 1981 The zinc/halogen batteries
[DE82-006987] p 23 N83-19331

ZINC CHLORIDES

Health and environmental effects document for
batteries, 1981 The zinc/halogen batteries
[DE82-006987] p 23 N83-19331
Generic environmental and safety assessment of 5
battery energy-storage systems
[DE82-902212] p 23 N83-19334

ZINC COMPOUNDS

The growth of Zn₃P₂ by metalorganic chemical vapor
deposition --- material for low cost photovoltaic devices
p 45 A83-26065

ZINC OXIDES

Hot-gas cleanup for molten-carbonate fuel cells
[DE82-002500] p 163 N83-16864

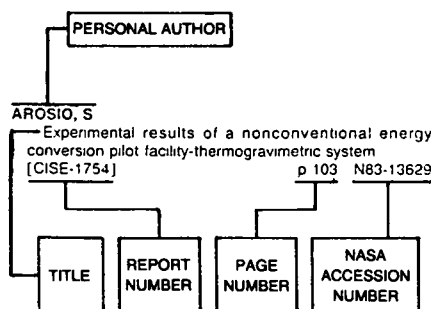
ZINC-OXYGEN BATTERIES

A zinc paste primary battery --- for electric vehicles
p 153 A83-26052

ZIRCONIUM OXIDES

Selecting and testing oxygen-measuring systems for
fluidized-bed combustors
[DE83-005987] p 128 N83-21089

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The page and accession numbers are located beneath and to the right of the title. Under any one author's name the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

A

- ABBASI, H. A.**
Multi-fuel low-NOx burner development, phase 2
[PB83-126292] p 147 N83-22845
- ABBATIELLO, L. A.**
Performance and economics of 8 alternative systems for residential heating, cooling, and water heating in 115 US cities
[DE83-003196] p 33 N83-21630
- ABBEY, D.**
Role of water in energy development
[DE82-011986] p 35 N83-22800
- ABBEY, K. M.**
Pore size engineering applied to starved electrochemical cells and batteries
p 154 A83-27201
- ABDASSAH, D.**
Lithology and hydrothermal alteration determination from well logs for the Cerro Prieto Wells, Mexico
[DE82-004677] p 101 N83-17000
- ABDURASHID, B.**
Parametric investigations and other related studies of energy storage type capacitors
[DE83-003426] p 197 N83-22785
- ABELSON, H. I.**
A technology assessment of solar energy systems. Direct combustion of wood and other biomass in industrial boilers
[DE83-000937] p 31 N83-21538
- ABOU-ARAB, T. W.**
Prediction of turbulent mixing in confined co-axial reacting jets
p 91 A83-23191
- ABOU-ELLAIL, M. M. M.**
Prediction of turbulent mixing in confined co-axial reacting jets
p 91 A83-23191
- ABRAMS, D. W.**
Development of residential-conservation-survey methodology for the US Air Force Task 2
[DE82-009473] p 18 N83-18077
- ACKERMAN, F. J.**
Oil shale project run summary small retort run S-7
[DE82-004731] p 99 N83-16837
- ADDIS, F. W.**
Experimental and theoretical studies of Cu₂O solar cells
p 40 A83-22907

- ADLER, D.**
Chalcogenide-glass solar cells
[DE82-021243] p 68 N83-20382
- ADOLFSON, W. F.**
Photovoltaic off-farm agricultural applications Volume 1 Executive summary
[DE82-008487] p 70 N83-20398
Photovoltaic off-farm agricultural applications Volume 2 Technical report
[DE82-009320] p 76 N83-21562
- AESCHLIMAN, D. P.**
Project DEEP STEAM
[DE82-010945] p 111 N83-18078
- AFANSEV, G. P.**
Higher level of utilization of fuel-energy resources [BLL-M-26855-(5825 4)] p 35 N83-22737
- AGARWAL, A. K.**
Mass balance results for the Princeton 1 underground coal gasification field test
[DE82-005667] p 162 N83-16556
- AGARWAL, P. D.**
Energy utilization of electric and hybrid vehicles
p 188 A83-27164
- AGNEW, A. F.**
Perspectives in non-fuel minerals p 112 N83-18143
- AL-ASTRABADI, F.**
A heat pipe simulation technique for spacecraft thermal testing under variable orientation
[SAE PAPER 820860] p 185 A83-25760
- AL-SANI, A.**
Operational results from the Saudi solar village photovoltaic power system p 48 A83-27240
- ALBELLA, J. M.**
Reactive sputtered Ta₂O₅ antireflection coatings
p 52 A83-27984
- ALBRIGHT, B. L.**
Wisconsin collector-efficiency study, phase two
[DE82-013425] p 71 N83-20426
- ALDRED, W. H.**
Ethanol production in small- to medium-size facilities
[DE83-900875] p 146 N83-22807
- ALEKSAKHIN, R. M.**
Pressing problems of radioecology in light of solving atomic energy problems p 36 N83-22977
- ALEXANDER, J. H.**
Dynamic simulation of sulfur-removal systems
[DE82-902074] p 119 N83-19865
- ALLAN, D. S.**
Ignition sources of LNG vapor clouds
[PB82-262577] p 96 N83-16461
- ALLEN, C. L.**
Status report on sulfur iodine thermochemical water-splitting cycle
[DE82-007164] p 88 N83-17633
- ALLEN, D. J.**
Investigation of the geothermal potential of the UK The Southampton (Western Esplanade) geothermal well A preliminary assessment of the resource
p 109 N83-18029
- ALLEN, D. M.**
Thermal energy storage - Air Force user considerations in various modes of operation p 190 A83-27305
- ALLEN, M. D.**
Results of u-bend stress-corrosion-cracking specimen exposures in coal-liquefaction pilot plants
[DE82-012889] p 105 N83-17708
- ALLEN, R. D.**
Factors affecting storage of compressed air in solution mined salt cavities p 191 A83-27311
Issues affecting storage of compressed air in solution-mined salt cavities
[DE83-002017] p 197 N83-22804
Aquifer compressed-air field experiment at Pittsfield, Illinois
[DE83-002057] p 198 N83-22805
- ALLGOOD, G. O.**
Dynamic modeling and control analysis of froth flotation and clean-coal filtration as applied to coal beneficiation
[DE82-004555] p 97 N83-16558

- ALTSEIMER, J. H.**
The promise and status of international applications of photovoltaics
[DE82-006152] p 16 N83-18042
- ALVIN, M. A.**
Trace and minor element reactions in fluidized-bed combustion processes
[PB82-240219] p 113 N83-18883
Gas characterization from fluidized-bed coal gasification
[DE82-012396] p 138 N83-22357
Evaluation of gasification and gas cleanup processes for use in molten carbonate fuel cell power plants
[DE83-003821] p 183 N83-22787
- AMBRUS, J. H.**
The NASA program in Space Energy Conversion Research and Technology p 160 A83-27326
- AMERO, R.**
Fuel quality-processing study Volume 2 Literature survey
[NASA-CR-165326-VOL-2] p 143 N83-22751
- AMICK, J. A.**
Practical limiting efficiencies for crystalline silicon solar cells p 37 A83-19893
- AMMANN, P. R.**
Study to establish cost predictions for the production of Redox chemicals
[NASA-CR-167882] p 194 N83-20359
- AMUNDSEN, C. B.**
National forecast for geothermal resource exploration and development with techniques for policy analysis and resource assessment
[DE82-014641] p 133 N83-21588
- ANDEEN, G. B.**
Development and demonstration of a reverse-osmosis energy-recovery device
[PB83-108605] p 140 N83-22380
- ANDERSEN, T. S.**
The MOD-OA 200 kilowatt wind turbine generator design and analysis report
[NASA-CR-165127] p 163 N83-16859
Multiple and variable speed electrical generator systems for large wind turbines p 170 N83-19236
- ANDERSON, D. N.**
Catalytic combustion with steam injection
[ASME PAPER 82-JPGC-GT-23] p 93 A83-25271
Critical research and advanced technology (CRT) support project
[NASA-TM-83019] p 123 N83-20361
- ANDERSON, L. M.**
A new strategy for efficient solar energy conversion - Parallel-processing with surface plasmons
p 46 A83-27140
- ANDERSON, P. M.**
Security assessment of power systems including energy storage and with the integration of wind energy Volume 1 Digital transient simulation effort consulting agreement number 1
[DE82-021063] p 164 N83-16915
- ANDERSON, T. D.**
Potential benefits of R and D directed toward increasing the cost-effectiveness of energy use
[DE83-013435] p 27 N83-20423
- ANDON, J.**
Review and evaluation of automotive fuel conservation technologies
[PB83-101139] p 30 N83-20844
- ANDRAWIS, A. S.**
Geology and structures study of the Nuba Mountains, Sudan, using Landsat images p 92 A83-24561
- ANDREWS, J. S.**
Development tests for the 2.5 megawatt Mod-2 wind turbine generator p 172 N83-19260
- ANDREWS, J. W.**
Development of polymer film solar collectors A status report
[DE83-005995] p 80 N83-21643
- ANGELO, J. A., JR.**
Advanced thermal-sensor-system development via shuttle sortie missions
[DE82-004932] p 98 N83-16834

- ANGUET, J.**
Industrial technology for economic and viable encapsulation for large solar panels
[PB82-259839] p 59 N83-16936
- AQUINO, J. T.**
The useful potential of using existing data to uniquely identify predictable wind events and regimes, part 1
p 116 N83-19250
- ARAYA F., M.**
Main advances and needs on the study of geothermal resources in Chile by using remote sensing techniques
p 91 A83-21946
Use of remote sensing techniques to study geothermal resources in and around semi-arid zones in Chile
p 92 A83-24577
- ARGABRIGHT, T. A.**
Metal hydride heat pump p 3 A83-27211
Metal hydride/chemical heat-pump development project, phase 1
[DE83-002463] p 27 N83-20429
- ARGYRIS, J. H.**
ARLIS 1.0 Linear investigation of aeroelastic systems in rotation
[ISD-293] p 166 N83-17905
Linear static and dynamic analysis for hinged rotor blades of 60 m span for a two bladed horizontal axis wind energy converter
p 167 N83-18030
- ARIMAN, T.**
Energy conservation in electrostatic fabric filtration of industrial dust
[DE82-006897] p 15 N83-18036
- ARIPOV, K. H. K.**
A method for producing heat pipes for cooling semiconductor photovoltaic cells and the heat pipe characteristics
p 52 A83-28366
- ARMAND, N. A.**
On the orientation precision of satellite solar power stations
p 41 A83-23164
- ARNDT, G. D.**
Optimization technique for improved microwave transmission from multi-solar power satellites
p 185 A83-27152
- ARNOLD, C. W.**
Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States
[DE82-011237] p 18 N83-18108
- ARNOLD, H. G.**
Steam ejector as an industrial heat pump
[DE82-010194] p 14 N83-17847
- ARUNDALE, C. J.**
Use of hot-dry-rock geothermal resources for space heating: A case study
[DE83-002947] p 135 N83-21636
User's manual for HDR3 computer code
[DE83-003993] p 136 N83-21828
- ASARO, R. J.**
Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures
[AD-A113883] p 72 N83-20802
- ASHTON, W. B.**
New priorities in energy-conservation research and development
[DE82-005988] p 16 N83-18054
- ASPLIDEN, C. I.**
World-wide resource assessment
[DE82-004272] p 102 N83-17024
Hybrid solar-wind energy conversion systems meteorological aspects
[DE82-005798] p 61 N83-18053
- AST, D. G.**
The structure of 110 tilt boundaries in large area solar silicon
[NASA-CR-170204] p 81 N83-22744
- ASTER, R.**
Automation of the longwall mining system
[NASA-CR-169933] p 114 N83-19183
- ASTRAND, L.**
Solar district heating with evacuated collectors: First year experience of the Knivsta plant
[PB82-262114] p 59 N83-16939
- ATMARAM, G. H.**
Innovative photovoltaic application for residences
[DE83-000399] p 57 N83-16898
- ATOR, J. T.**
A method of evaluating and sizing solar cogeneration systems
p 41 A83-23127
- AUBRY, D.**
Finite element analysis of mixed convection applied to the storage of solar energy
p 42 A83-23219

- EVERY, D. H.**
Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures
[AD-A113883] p 72 N83-20802
- EVERY, J. W.**
Development of a high capacity toroidal Ni/Cd cell
[NASA-CR-169945] p 174 N83-19273
- AWAYA, H.**
Configuration selection study for isolated loads
p 41 A83-23137
- AWAYA, H. I.**
Comparison of advanced thermal and electrical storage for parabolic dish solar thermal power systems
p 47 A83-27232
- AXELL, R. A.**
Test status and experience with the 7.5 megawatt Mod-2 wind turbine cluster
p 172 N83-19261
- AYERS, K.**
Fuel cell electrolyte for portable electrical generating equipment
[AD-A121176] p 174 N83-19275

B

- BABU, P. V. L. P.**
Structural geomorphology of Rajasthan basin, India-interpreted through Landsat imagery and aerial photos
p 92 A83-24626
- BABU, S.**
Gasification of land-based biomass
[PB83-109918] p 122 N83-19946
- BADER, C. F.**
Prospects of motor vehicles as a means of transportation and of alternative drives
p 148 N83-23215
- BAILEY, E. M.**
The seasonal variation of the atmospheric SO₂ to SO₄²⁻ conversion rate
p 2 A83-24279
- BAIR, W. G.**
Coal gasification for stationary gas-turbine applications
[DE82-902135] p 97 N83-16553
- BAKER, E. G.**
Steam gasification of wood in the presence of catalysts
[DE82-005919] p 162 N83-16557
- BAKER, G. G.**
Effects of several disposable catalysts on liquefaction of lignite
[DE82-022188] p 138 N83-22351
Liquefaction behavior of a Canadian subbituminous coal in comparison with several US lignites and subbituminous coals
[DE82-021976] p 146 N83-22824
- BAKER, J.**
FDAS hardware and firmware description, Liquefied Gaseous Fuels (LGF) data-acquisition system
[DE82-012602] p 107 N83-17741
- BAKER, N.**
A clean internal combustion engine for underground mining machinery: A technical assessment and program plan, phase 1
[PB82-244724] p 89 N83-19104
- BALDWIN, R. M.**
Mechanisms and kinetics of coal hydrogenation
[DE82-012338] p 105 N83-17677
- BALENTINE, H. W.**
Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States
[DE82-011237] p 18 N83-18108
- BALL, J. G.**
Acid rain mitigation study: Volume 1 FGD cost estimates
[PB83-101329] p 29 N83-20459
Acid rain mitigation study: Volume 2 FGD cost estimates, appendices
[PB83-117366] p 29 N83-20469
- BANKAITIS, H.**
Implementation of R & QA practices in Research and Development programs
[NASA-TM-82997] p 24 N83-19651
- BARAONA, C. R.**
Screen printed interdigitated back contact solar cell
[NASA-CASE-LEW-13414-1] p 68 N83-20374
- BARBER, D.**
Fuel conservation and economy constraints
p 34 N83-22179
- BARBER, J. P.**
Repetitive switching for inductive energy storage
[AD-A121029] p 194 N83-19277
- BARCET, W. R.**
Approaches to wind resource verification
p 116 N83-19238
- BARCLAY, J. A.**
The effect of parasitic refrigeration on the efficiency of magnetic liquefiers
p 155 A83-27212

- BARFIELD, B. F.**
Increasing summer peak power with aquifer storage
p 191 A83-27313
- BARHAM, S. S.**
Potential biological hazards of nickel arsenides associated with retorting of oil shale: Toxic effects of particulate Ni₃As₂
[DE82-010978] p 22 N83-19328
- BARICH, J. J.**
Emulsified fuel testing in a medium speed diesel engine
[PB82-250697] p 98 N83-16564
- BARNES, G. D.**
A preliminary study of environmental parameters associated with the feasibility of a polygeneration plant at Kennedy Space Center
p 11 N83-17365
- BARNES, P. R.**
A review of utility issues for the integration of wind electric generators
p 173 N83-19269
- BARNES, R. W.**
Performance and economics of residential solar space heating
[DE83-003187] p 79 N83-21626
- BARNETT, A. N.**
Design rules for a 100X maximum efficiency GaAs concentrator solar cell for space applications
[NASA-CR-170005] p 67 N83-20362
- BARNUM, J. R.**
Electrical overstress failure in silicon solar cells
[DE83-004475] p 80 N83-21637
- BARRA, O. A.**
A 2D model of turbulent solar induced flows in passive air collectors
p 53 A83-29039
- BARTEL, L. C.**
Site selection and characterization for an underground coal gasification test in Washington State: Volume 2 Project details
[DE82-010948] p 19 N83-18117
- BARTHELEMY, R. R.**
Spacecraft power technology
p 153 A83-27157
- BARTLETT, D.**
Solar receiver cavity insulation evaluation
p 39 A83-22275
- BARTLETT, D. H.**
The 1-MW(th) solar-thermal conversion full-system experiment
[DE82-906454] p 59 N83-16920
- BARTON, R. S.**
Control design and performance analysis of a 6 MW wind turbine-generator
p 162 A83-29897
Experience and assessment of the DOE/NASA Mod-1 2000 kW wind turbine generator at Boone, North Carolina
p 172 N83-19257
Conceptual design of the 6 MW Mod-5A wind turbine generator
p 173 N83-19271
- BASIULIS, A.**
Design, fabrication and test of liquid metal heat-pipe sandwich panels
[NASA-TM-84631] p 187 N83-22541
- BASKIN, J. M.**
Development tests for the 2.5 megawatt Mod-2 wind turbine generator
p 172 N83-19260
- BASS, R. W.**
Evaluation of industrial advanced heat recovery/thermal energy storage systems
[DE82-906475] p 193 N83-16919
- BAST, J. A.**
Development of advanced batteries for utility application
[DE82-906459] p 193 N83-16918
- BATES, B.**
An advanced electric vehicle powertrain
p 154 A83-27161
- BATESOLE, W. R.**
Fiberglass composite blades for the 2 MW Mod-1 wind turbine generator
p 170 N83-19241
- BATTERMAN, S.**
Estimating pollutant exposures from coal fired power plants in a rural region
[DE82-008136] p 19 N83-18109
- BATTRICK, B.**
Fourth ESTEC spacecraft power-conditioning seminar
[ESA-SP-186] p 176 N83-21006
- BAUM, D. W.**
High power pulsed plasma MHD experiments
[AD-A120526] p 176 N83-20781
High power pulsed plasma MHD experiments
[AD-A120526] p 176 N83-20782
- BAXTER, V. D.**
Annual cycle energy system performance and national economic comparisons with competitive residential HVAC systems
[DE82-010188] p 68 N83-20377

- BAXTER, W. H.**
Transportation network models for energy supply analysis Volume 1 Executive summary [DE82-903077] p 187 N83-20399
Transportation network models for energy supply analysis Volume 3 Transportation network model user's guide and documentation [DE82-903079] p 187 N83-20400
- BAYLOR, V. B.**
Results of u-bend stress-corrosion-cracking specimen exposures in coal-liquefaction pilot plants [DE82-012889] p 105 N83-17708
Coal-liquefaction-plant fractionation-column corrosion-coupon studies [DE82-007469] p 139 N83-22360
- BAYNE, C. K.**
Investigation of attic-insulation effectiveness using actual energy-consumption data [DE82-006822] p 17 N83-18055
Investigation of attic insulation effectiveness using actual energy consumption data [DE83-000225] p 36 N83-22828
- BEBERMEIER, H.**
Technology of elevated voltage solar arrays Key items test and evaluation Part 2 Simulated LEO-plasma tests [ESA-CR(P)-1646] p 73 N83-21513
- BECCASIO, A. D.**
Gulf coast ecological inventory user's guide and information base [DE83-900406] p 28 N83-20455
- BECHTOLD, R. L.**
An assessment of the multifuel capability and alternative fuel potential of the automotive Stirling engine /ASE/ [DE82-007469] p 156 A83-27273
- BECKER, F. E.**
Open-cycle vapor compression heat pump [PB82-262569] p 8 N83-16947
- BEEKLEY, P. K.**
Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States [DE82-011237] p 18 N83-18108
- BEER, J. M.**
Design strategy for the combustion of coal-derived liquid fuels [DE82-905496] p 95 N83-16444
- BEER, R. G.**
Oil/refuse homogenization An approach to combustion of refuse in existing oil-fired boilers [DE82-011848] p 138 N83-22353
- BEERS, D.**
Helo-Thermics, Inc., lot no 8, single family residence, Greenville, South Carolina [DE82-012822] p 65 N83-19283
- BELEY, J. R.**
Decision framework for technology choice Volume 1 A case study of one utility's coal-nuclear choice [DE82-902213] p 113 N83-18554
- BELKANIYA, G. S.**
Study of psychophysiological distinctions of primates using delayed reaction test p 85 N83-26442
- BELL, D. J.**
Benefits to utility systems of coproduction of methanol and electricity [DE83-900279] p 101 N83-16913
- BELLAS, G. T.**
Combustion of solvent-refined coal in a 100 HP firetube boiler [DE82-007670] p 103 N83-17640
- BELLER, M.**
Systems analysis of hydrogen supplementation in natural gas pipelines [DE82-006933] p 89 N83-17740
- BENENATI, R.**
HYFIRE A Tokamak/high-temperature electrolysis system [DE82-004803] p 88 N83-17323
HYFIRE A Tokamak/high-temperature electrolysis system [DE82-013851] p 90 N83-23173
- BENNER, J. P.**
Effects of grain boundaries in GaAs solar cells [DE82-006118] p 61 N83-18059
- BENNET, J. E.**
Vaporization thermodynamics of K2S and K2SO3 [NASA-CR-168080] p 117 N83-19812
- BENNETT, A.**
Design of hydraulic output unit for 15 kW free-piston Stirling engine p 157 A83-27277
- BENNETT, L. C.**
Fatigue testing of low-cost fiberglass composite wind turbine blade materials [NASA-CR-165566] p 181 N83-22746
- BENSON, J. E.**
Fossil-energy [DE83-003817] p 124 N83-20383
- BERCHTOLD, M.**
Supercharging with Comrex p 168 N83-18940
- BERG, L.**
Catalytic hydrogenation of coal-derived liquids [DE83-003582] p 126 N83-21068
- BERG, R.**
Parametric analysis of closed cycle magnetohydrodynamic (MHD) power plants [NASA-CR-165472] p 182 N83-22748
- BERGER, D. A.**
The comprehensive community energy management program An evaluation [DE82-011552] p 17 N83-18060
- BERGERON, P. W.**
Reversible chemical reactions for energy storage in a large-scale heat utility p 51 A83-27315
- BERGGREN, R. W.**
Effects of displacer seal clearance on free-piston Stirling engine performance p 158 A83-27295
- BERGLUND, G. R.**
Design, construction, operation and costs of a modern small-scale fuel-alcohol plant [DE82-011019] p 107 N83-17754
- BERK, J. V.**
Radon-daughter exposures in energy-efficient buildings [DE82-003711] p 9 N83-16964
- BERKMAN, E.**
High resolution seismic survey of the Hanna, Wyoming underground coal gasification area [DE82-006887] p 112 N83-18137
- BERMAN, P. A.**
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model [DE83-004004] p 197 N83-22758
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, Part 1 Turbomachinery design [DE83-004005] p 197 N83-22759
- BERNTELL, J.**
Stirling engines for solar power generation in the 50 to 500 kW range p 50 A83-27274
- BERUBE, N.**
Federal applications for wind energy systems A subcontract report [DE83-000306] p 31 N83-21543
- BESENBRUCH, G. E.**
Status report on sulfur iodine thermochemical water-splitting cycle [DE82-007164] p 88 N83-17633
- BESON, R. P.**
Programmatic environmental overview Biomass fuels program [DE82-906065] p 101 N83-16975
- BESSON, J. M.**
Photoconductivity and photovoltaic effect in indium selenide p 39 A83-22337
- BEVILACQUA, O.**
Contemporary electric vehicle testing and evaluation p 3 A83-27160
- BEZDEK, R.**
Can industry afford solar energy p 44 A83-25144
- BHATTNAGAR, P. K.**
Al-Si peaked Schottky barriers p 40 A83-22903
- BHATTACHARYA, A.**
Influence of diffusion of hot carriers on collection efficiency of solar cells - a-Si H p 42 A83-23665
- BICKFORD, J. H.**
A study of bolting problems, tools, and practices in the nuclear industry [DE82-902203] p 168 N83-19099
- BIELAWA, R. L.**
Development of an oscillating-vane concept as an innovative wind-energy-conversion system [DE82-012870] p 179 N83-21599
- BIGGANE, J.**
Low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington [DE83-001433] p 145 N83-22789
- BIGGER, J.**
Solar receiver cavity insulation evaluation p 39 A83-22275
- BIGGS, D. L.**
Fossil-energy [DE83-003817] p 124 N83-20383
- BIGGS, F.**
Simplified calculational procedure for determining the amount of intercepted sunlight in an imaging solar concentrator p 43 A83-23884
- BINGHAM, J. M.**
Fractionation of an oil shale retort process water Isolation of photoactive genotoxic components [DE82-010428] p 108 N83-18014
- BIRCH, P.**
Orbital ring systems and Jacob's Ladders III p 185 A83-29457
- BIRCHENOUGH, A. G.**
Operating experience with four 200 kW Mod-OA wind turbine generators p 171 N83-19256
- BIRD, R. E.**
Additional solar spectral data sets p 199 A83-25450
Terrestrial solar spectral data sets [DE83-000504] p 60 N83-17001
- BIRLINGMAIR, D.**
Fossil-energy [DE83-003817] p 124 N83-20383
- BIRUR, G. C.**
Comparison of advanced thermal and electrical storage for parabolic dish solar thermal power systems p 47 A83-27232
- BIVINS, R. L.**
Use of hot-dry-rock geothermal resources for space heating A case study [DE83-002947] p 135 N83-21636
- BIXEL, H. C.**
Reservoir engineering transient pressure well testing, and petrophysical analyses of western gas sands [DE82-004879] p 99 N83-16839
- BLACKWELL, D. D.**
Heat flow and geothermal potential of Kansas [DE83-003235] p 134 N83-21609
- BLAIR, P. D.**
National forecast for geothermal resource exploration and development with techniques for policy analysis and resource assessment [DE82-014641] p 133 N83-21588
- BLAKE, T. R.**
Dynamic simulation of sulfur-removal systems [DE82-902074] p 119 N83-19865
- BLAKELY, R. J.**
Present and potential use of micro-hydroelectric schemes in remote locations [DE82-904687] p 26 N83-20411
- BLAKESLEE, A. E.**
Effects of grain boundaries in GaAs solar cells [DE82-006118] p 61 N83-18059
- BLAUSTEIN, B. D.**
Conversion of coal to synthetic fuels p 144 N83-22768
- BLAZEK, C. F.**
Hybrid fuel cell/diesel generation total energy system, part 2 [NASA-CR-169912] p 115 N83-19217
Hydrogen use in a rural Alaskan community [DE83-000568] p 90 N83-22813
- BLEILER, K. W.**
Coal desulfurization by a microwave process [DE82-007514] p 118 N83-19854
- BLODGET, H. W.**
ERRSAC contributions to the search for Appalachian hydrocarbons p 114 N83-19155
- BLOOMFIELD, S.**
Systems analysis of on-site integrated energy systems, phase 1 [DE83-000044] p 179 N83-21549
- BLOOMSTER, C. H.**
User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 1 Main text [DE82-022512] p 99 N83-16865
User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 2 Appendices [DE82-022511] p 99 N83-16866
- BLUMENFELD, H.**
EA study of solar concentrator panels with fluorescent compounds p 40 A83-22911
- BOBBETT, R. E.**
Acid fuel cell technologies for vehicular power plants p 154 A83-27185
- BODA, F. P.**
Preliminary test results for the small community solar power system [ASME PAPER 82-WA/SOL-30] p 44 A83-25687
- BODENSCHATZ, C. A.**
The MOD-OA 200 kilowatt wind turbine generator design and analysis report [NASA-CR-165127] p 163 N83-16859
- BODVARSSON, G. S.**
Mathematical modeling of the behavior of geothermal systems under exploitation [DE82-010925] p 133 N83-21587
- BOEGEL, M. L.**
Radon-daughter exposures in energy-efficient buildings [DE82-003711] p 9 N83-16964

- BOES, E. C.**
Photovoltaic-concentrator technology in the USA
[DE82-016399] p 68 N83-20387
- BOESCH, L.**
Preliminary evaluation of environmental issues on the use of peat as an energy source
[DE83-000820] p 34 N83-21651
- BOETHELI, J. C.**
Programmatic environmental overview Biomass fuels program
[DE82-906065] p 101 N83-16975
- BOGGIATTO, D.**
A heat pipe simulation technique for spacecraft thermal testing under variable orientation
[SAE PAPER 820860] p 185 A83-25760
- BOHAC, C. E.**
Programmatic environmental overview Biomass fuels program
[DE82-906065] p 101 N83-16975
- BOIAKHCHIAN, G. P.**
On the choice of the optimal density of vibrators for a rectenna
p 184 A83-23464
- BOIARSKI, A.**
Combustion of oil on water An experimental program
[DE82-014598] p 127 N83-21084
- BOLIVAR, S. L.**
Uranium hydrogeochemical and stream sediment reconnaissance of the St. Michael NTMS quadrangle, Alaska
[DE82-009999] p 99 N83-16844
Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197
- BOMAR, S. H., JR.**
Design of a vortex-flow solar chemical reactor
[DE83-000031] p 58 N83-16914
- BONK, J. S.**
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model
[DE83-004004] p 197 N83-22758
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, Part 1 Turbomachinery design
[DE83-004005] p 197 N83-22759
- BONNER, M.**
Current research in advanced water electrolysis in the United States and abroad p 87 A83-27216
- BOOKER, J. M.**
A data-gathering method for use in modeling energy research, development and demonstration programs
[DE82-006153] p 16 N83-18040
- BOOM, R. W.**
Superconductive energy storage
[DE83-002270] p 196 N83-21624
- BOOTH, G. C.**
High temperature erosion and erosion-hot corrosion of superalloys and coatings p 91 A83-21458
- BOPARAI, A. S.**
Toxicology of coal gasification Chemical characterization p 148 N83-22960
- BORDEN, P. G.**
Single and multijunction space solar cells grown by organometallic vapor phase epitaxy /OM-VPE/
p 50 A83-27260
Design and demonstration of a spectrum-splitting photovoltaic concentrator module
[DE83-003669] p 79 N83-21634
- BORG, I. Y.**
Coal as an option for power generation in US territories of the Pacific
[DE82-009462] p 98 N83-16563
US energy flow, 1981
[DE83-001579] p 18 N83-18081
- BORGHI, C. A.**
Discharges in the inlet region of a noble gas MHD generator p 161 A83-28643
- BORHANIAN, H.**
Design and component testing of a low-temperature waste-heat-driven refrigeration system, phases 1 and 2
[DE82-014721] p 179 N83-21571
- BOTOMBEKOVA, A. B.**
A physiological and hygienic evaluation of the work regime of operators who are working in current energy production in Kirghizia p 4 A83-28765
- BOTTS, T.**
Current research in advanced water electrolysis in the United States and abroad p 87 A83-27216
- BOTTS, T. E.**
Nuclear reactors using fine particulate fuel for primary power in space p 155 A83-27221
- BOUDREAU, R. A.**
Chemical bath deposition of thin film cadmium selenide for photoelectrochemical cells p 38 A83-20594
- BOUQUET, F.**
Evaluation of solar reflective surfaces for dish concentrators p 48 A83-27237
- BOURDINAUD, M.**
EA study of solar concentrator panels with fluorescent compounds p 40 A83-22911
- BOWDEN, J. N.**
Nonstandard aging tests on coal-derived distillate fuels
[DE82-010442] p 97 N83-18562
Fuel property effects on diesel engine and gas turbine combustor performance
[AD-A120879] p 175 N83-20161
- BOWEN, J. S., JR.**
State-of-the-art combustion modification NOx control for stationary combustion equipment
[PB82-240201] p 23 N83-19340
- BOWLES, R. L.**
The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations p 11 N83-17459
- BOWYER, J.**
Configuration selection study for isolated loads p 41 A83-23137
- BOWYER, J. M.**
Comparison of advanced thermal and electrical storage for parabolic dish solar thermal power systems p 47 A83-27232
- BOYD, D.**
Economic feasibility of solar thermal industrial applications and selected case studies
[DE82-009503] p 66 N83-19303
- BRADLEY, R. A.**
Advanced research and technology development fossil energy materials program
[DE82-007121] p 111 N83-18085
Fossil energy materials program plan for fiscal years 1982 through 1986
[DE83-004237] p 131 N83-21519
- BRADSHAW, R. W.**
Thermal-convective-loop correction tests of 316SS and IN800 in molten nitrate salts
[DE82-012313] p 66 N83-19898
- BRADSHAW, T. T.**
Environmental data for sites in the National Solar Data Network
[DE82-007055] p 64 N83-19280
- BRANZ, M.**
Economic feasibility of solar thermal industrial applications and selected case studies
[DE82-009503] p 66 N83-19303
- BRATT, C.**
Stirling engines for solar power generation in the 50 to 500 kW range p 50 A83-27274
- BRAUN, K. A.**
Linear static and dynamic analysis for hinged rotor blades of 60 m span for a two bladed horizontal axis wind energy converter
[ISD-291] p 167 N83-18030
- BRAUNSTEIN, A.**
The loss of power supply probability as a technique for designing stand-alone solar electrical (photovoltaic) systems p 54 A83-29896
- BRAUNSTEIN, J.**
Physical chemistry of molten-salt batteries Current-induced composition gradients in molten LiCl-KCl
[DE83-001684] p 192 N83-16875
Electromigrational composition gradients in molten carbonates A review
[DE83-002593] p 177 N83-21075
- BRAUWEILER, H.**
Flue gas desulfurization with waste water evaporation Phase 2 Observation of the experiments at Weher II
[BMFT-FB-T-82-026] p 125 N83-21053
- BRAY, J. J.**
Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures
[AD-A113883] p 72 N83-20802
- BRENDEN, B. B.**
Design of highwall mining equipment electronic guidance package
[DE82-006115] p 108 N83-18005
- BREUER, F.**
Replacement of lumpy chrome ore by agglomerated ore concentrates and lowering of specific power consumption and improvement of Cr yield by means of improved slag composition in the production of HC ferrochrome
[BMFT-FB-T-82-084] p 7 N83-16929
- BREWER, G. D.**
Fuel for future transport aircraft p 85 A83-20082
Is LH2 the high cost option for aircraft fuel p 87 A83-27215
- BRIGGS, C. K.**
US energy flow, 1981
[DE83-001579] p 18 N83-18081
- BRIGGS, R.**
Automated installation methods for photovoltaic arrays
[DE83-004272] p 82 N83-22796
- BRILMYER, G.**
A zinc paste primary battery p 153 A83-26052
- BRITT, E. J.**
Improved Stirling engine performance using jet impingement p 158 A83-27288
Direct conversion nuclear reactor space power systems p 158 A83-27296
- BROBERG, K. B.**
Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures
[AD-A113883] p 72 N83-20802
- BRODERS, M. A.**
District heating and more-efficient buildings
[DE81-025437] p 26 N83-20379
- BROECHNER, J.**
Swedish national and local government programs for conservation of energy in buildings
[PB82-246752] p 22 N83-19307
- BROEHL, J. H.**
Design and market study of photovoltaic systems for commercial building and applications Volume 3 Appendices
[DE82-016729] p 70 N83-20397
- BRONICKI, L. Y.**
Twenty years of experience with organic Rankine cycle turbines - Their applicability and use in energy conservation and alternative energy systems p 3 A83-27207
- BRONZINI, M. S.**
Transportation network models for energy supply analysis Volume 1 Executive summary
[DE82-903077] p 187 N83-20399
Transportation network models for energy supply analysis Volume 3 Transportation network model user's guide and documentation
[DE82-903079] p 187 N83-20400
- BROWN, C. D.**
Biostatistics and health impacts of energy technologies p 36 N83-22962
- BROWN, C. H., JR.**
Dynamic modeling and control analysis of froth flotation and clean-coal filtration as applied to coal beneficiation
[DE82-004555] p 97 N83-16558
- BROWN, C. T.**
Advanced component research in the solar thermal program p 47 A83-27233
- BROWN, D. R.**
AQUASTOR - A computer model for cost analysis of aquifer thermal energy storage coupled with district heating or cooling systems p 191 A83-27314
Cost of heat from a seasonal source
[DE82-006026] p 194 N83-18045
- BROWN, G. S.**
Evaluation of wind-driven retroreflective taxiway edge markers
[DOT/FAA/RD-82/80] p 94 N83-16353
- BROWN, L.**
Role of water in energy development
[DE82-011986] p 35 N83-22800
- BROWN, L. C.**
A viable process for producing hydrogen synfuel using nuclear fusion heat p 87 A83-27210
Status report on sulfur iodine thermochemical water-splitting cycle
[DE82-007164] p 88 N83-17633
- BROWN, P. W.**
An evaluation of hydrated calcium aluminate compounds as energy storage media
[PB82-249921] p 194 N83-19308
- BROWNELL, D. H., JR.**
Dynamic simulation of sulfur-removal systems
[DE82-902074] p 119 N83-19865
- BROXTON, D. R.**
Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska
[DE82-009666] p 115 N83-19196
- BRUCE, C. W.**
Propagation at 10 microns through smoke produced by atmospheric combustion of diesel fuel p 3 A83-26641
- BRUGGINK, P.**
Fuel quality/processing study Volume 3 Fuel upgrading studies
[NASA-CR-165326-VOL-3] p 144 N83-22754
- BRYANT, J.**
Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment
[NASA-CR-169801] p 191 N83-16858

- BUCHLIN, J. M.**
A 2D model of turbulent solar induced flows in passive air collectors p 53 A83-29039
- BUCK, J. W.**
Vertical extrapolations of wind speed [DE83-000944] p 136 N83-21723
- BUCKLEY, B. S.**
Performance characteristics and design criteria for the thermic diode, a passive thermosyphon solar heating system [DE82-012455] p 78 N83-21604
- BULLARD, C. W.**
Residential and commercial cogeneration systems assessment [PB82-240037] p 22 N83-19314
- BUNDAS, D.**
Some experiments on Yaw stability of wind turbines with various coning angles [NASA-CR-168108] p 181 N83-22740
- BUNNELL, R.**
Exploratory study of coal conversion chemistry [DE82-013414] p 138 N83-22354
- BUONCRISTIANI, A. M.**
Semiconductor photoelectrochemistry [NASA-TP-2088] p 167 N83-18024
- BURAS, N.**
Modeling water supply for the energy sector p 25 N83-20336
- BURCAT, A.**
Shock initiated ignition in heptane-oxygen-argon mixtures p 93 A83-26198
- BURDICK, P. A.**
Compression molded energy storage flywheels p 189 A83-27303
- BURGESS, W. G.**
Investigation of the geothermal potential of the UK The Southampton (Western Esplanade) geothermal well A preliminary assessment of the resource p 109 N83-18029
- BURGHARD, H. C.**
Metallurgical investigation of disc cracking in the LP-2 turbine at a nuclear power station [DE82-906428] p 162 N83-16515
- BURIAN, L. C.**
Fuel supply and distribution Fixed base operation p 141 N83-22449
- BURKE, A. F.**
The relative attractiveness of electric and hybrid passenger cars p 3 A83-27159
- BURKE, W. R.**
Evaluation of various solar-cell-to-interconnector welds by means of scanning laser acoustic microscopy and metallography [ESA-STM-225] p 73 N83-21514
- BURNESS, H. S.**
Use of hot-dry-rock geothermal resources for space heating A case study [DE83-002947] p 135 N83-21636
- BURNHAM, A. K.**
Utilization of oil shales and basic research in organic geochemistry p 144 N83-22766
- BURNS, J. R.**
Shading analysis of a photovoltaic-cell string illuminated by a parabolic-trough concentrator [DE83-002646] p 74 N83-21537
- BUROLIA, V. P.**
Testing and evaluation of second-generation heliostat mirror modules [DE82-007934] p 77 N83-21582
- BUROUGH, I. G.**
Development of a continuous methane monitor [PB82-244245] p 114 N83-19078
- BURWELL, C. C.**
Electric home heating Substitution for oil and gas [DE82-013762] p 133 N83-21581
- BUSCHMANN, H. W.**
Fundamental research on Fischer-Tropsch synthesis [BMFT-FB-T-82-020] p 125 N83-21052
- BUSHNELL, D. J.**
Effect of low-proof alcohol fumigation-fueling on crankcase oil dilution in a diesel-cycle engine [DE83-002976] p 122 N83-20171
- BUSSOLARI, R. J.**
Fiberglass composite blades for the 4 MW - WTS-4 wind turbine p 170 N83-19243
Status of the 4 MW WTS-4 wind turbine p 172 N83-19263
- BUTLER, G. B.**
Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery [DE82-008705] p 140 N83-22436
- BUTLER, N. G.**
Initial utility experience with cluster of three Mod-2 wind turbine systems p 173 N83-19268
- BYVIK, C. E.**
Semiconductor photoelectrochemistry [NASA-TP-2088] p 167 N83-18024
Chalcogenophosphate photoelectrodes [NASA-CASE-LAR-12958-1] p 60 N83-18025
- C**
- CADA, G. F.**
Analysis of environmental issues related to small-scale hydroelectric development 6 Dissolved oxygen concentrations below operating dams [DE82-007127] p 22 N83-19329
- CAGLIOSTRO, L. A.**
Landfill gas to electricity demonstration project [PB82-255290] p 7 N83-16943
- CALCOTE, H. F.**
Effect of molecular structure on incipient soot formation p 90 A83-19847
- CALLAHAN, J. C.**
Production costing of an Advanced/Innovative Wind Energy Concept (AIWEC) Extension of the SAMICS methodology [DE83-003085] p 182 N83-22783
- CALLAHAN, T. J.**
Refining studies and engine testing of alternative highway-transportation fuels Identification and evaluation of optimized alternative fuels [DE83-003332] p 129 N83-21172
- CAMARDA, C. J.**
Design, fabrication and test of liquid metal heat-pipe sandwich panels [NASA-TM-84631] p 187 N83-22541
- CAMPBELL, E. M.**
Laser-plasma interaction experiments at laser wavelengths of 1 064 micron, 0 532 micron and 0 355 micron [DE82-013992] p 175 N83-20114
- CANDERS, W.-R.**
The calculation of energy storage flywheels of fiber composites with electric energy converter p 191 A83-28666
- CANON, R. M.**
Metal recovery from eastern oil shale [DE82-004052] p 109 N83-18016
- CANRIGHT, G. S.**
Dynamic modeling and control analysis of froth flotation and clean-coal filtration as applied to coal beneficiation [DE82-004555] p 97 N83-16558
- CANTOR, S.**
Energy-data validation An overview and some concepts [DE82-020901] p 27 N83-20431
- CARD, M. F.**
Structures and mechanisms - Streamlining for fuel economy p 2 A83-24361
- CARLSON, D. D.**
Interim Reliability Evaluation Program (IREP) [DE82-004132] p 5 N83-16777
- CARNE, T. G.**
Modal testing of a rotating wind turbine [DE83-003630] p 178 N83-21526
Finite-element analysis and modal testing of a rotating wind turbine [DE83-002609] p 180 N83-21608
- CARNES, B. A.**
Biostatistics and health impacts of energy technologies p 36 N83-22962
- CARON, R. N.**
Ignition sources of LNG vapor clouds [PB82-262577] p 96 N83-16461
- CARRATELLI, E. P.**
A 2D model of turbulent solar induced flows in passive air collectors p 53 A83-29039
- CARRIERE, W. M.**
Synthetic fuels for transportation Background paper 1 The future potential of electric and hybrid vehicles [PB83-126086] p 37 N83-23250
- CARROLL, C.**
Sperry low-temperature geothermal conversion system Volume 1 Organic-working-fluid properties [DE82-018529] p 163 N83-16867
- CASAMAJOR, A. B.**
Oil shale project run summary small retort run S-7 [DE82-004731] p 99 N83-16837
- CASPER, R. A.**
Solar-augmented applications in industry Phase 2 Conceptual designs, volume 1 [PB83-102301] p 72 N83-20441
- CASSEL, T. A. V.**
National forecast for geothermal resource exploration and development with techniques for policy analysis and resource assessment [DE82-014641] p 133 N83-21588
- CASSINELLI, J. E.**
Solar array switching power management p 45 A83-27132
Study of solar array switching power management technology for space power system [NASA-CR-167890] p 81 N83-22756
- CASTANI, C.**
Evaluation of deterioration due to hot creep in chrome-molybdenum ferritic steels used in thermal power stations [BLL-CE-TRANS-7669-(9022 09)] p 162 N83-16470
- CASTANO, J. R.**
Exploitation deliberations p 144 N83-22763
- CASTLE, J. G., JR.**
Mass flow of char/coal in oxygen-blown entrained-bed gasifiers An assessment of instruments and methods of measurement [DE82-006988] p 107 N83-17852
- CATAN, M. A.**
Optimal heat pumps for solar-assisted heat-pump systems [DE82-004798] p 55 N83-16688
Steady-state testing of an advanced solar-assisted heat pump [DE83-002343] p 66 N83-19297
- CATTOLICA, R. J.**
Laser fluorescence measurements of the OH concentration in a combustion boundary layer p 86 A83-24367
- CERNANSKY, N. P.**
Droplet size effects on NO_x/x₁ formation in a one-dimensional monodisperse spray combustion system [ASME PAPER 82-JPGC-GT-10] p 93 A83-25268
- CHADWICK, D. G.**
Design considerations in the use of Glauber salt for energy storage [DE82-019289] p 192 N83-16868
- CHAFE, R. E.**
Energy conservation in air transportation - The Canadian Air Traffic Control Effort p 4 A83-29393
- CHAI, A. T.**
Screen printed interdigitated back contact solar cell [NASA-CASE-LEW-13414-1] p 68 N83-20374
- CHAIN, E. E.**
Chemically vapor-deposited black molybdenum films of high IR reflectance and significant solar absorptance p 44 A83-25534
- CHAKAKIS, N. J.**
The HFEM monitoring of coal gasification Rawlins, Wyoming [DE82-013801] p 142 N83-22466
- CHAMBERLAIN, G. A.**
Organic solar cells - A review p 44 A83-25449
- CHAMPNESS, C. H.**
A semiconductor-insulator-semiconductor CdO-SiO₂-Si solar cell p 41 A83-22912
- CHAN, L. K.**
Synthetic-fuel aromaticity and staged combustion [DE82-010302] p 118 N83-19858
- CHANG, C. S.**
Coal-gasification and tar-conversion reactions over calcium oxide [DE82-014635] p 139 N83-22358
- CHANG, G. C.**
Performance degradation and cleaning of photovoltaic arrays p 48 A83-27236
- CHANT, V. G.**
Two global scenarios The evolution of energy use and the economy to 2030 [IIASA-RR-81-35] p 14 N83-18021
- CHAPPELL, J. R.**
Status of DOE small hydropower research and development projects [DE83-001353] p 125 N83-20434
- CHARLIER, R. H.**
Developments in tidal power p 155 A83-27226
- CHAUBE, U. C.**
Two level multi-objective reconnaissance system study of a large water resource system [PB82-239716] p 20 N83-19213
- CHEEK, G.**
Metal-insulator-semiconductor silicon solar cells p 44 A83-25447
- CHEN, C.**
Coal pyrolysis by hot solids from a fluidized-bed combustor [DE83-003344] p 117 N83-19829
- CHEN, C. P.**
Minimum silicon wafer thickness for ID wafering p 41 A83-22924
- CHEN, D. J. C.**
Fractionation of an oil shale retort process water Isolation of photoactive genotoxic components [DE82-010428] p 108 N83-18014

- CHEN, F. C.**
Hydraulic air compressor for ocean thermal energy conversion applications
[DE82-005198] p 163 N83-16880
- CHERNOFF, H.**
Assessment of distributed solar power systems Issues and impacts
[DE83-900640] p 78 N83-21618
- CHERRY, N. J.**
World-wide resource assessment
[DE82-004272] p 102 N83-17024
- CHEUNG, P. K.**
Geothermal resource assessment in Oklahoma
[DE82-021288] p 100 N83-16874
- CHEVY, A.**
Photoconductivity and photovoltaic effect in indium selenide
p 39 A83-22337
- CHI, J. W. H.**
HYFIRE A Tokamak/high-temperature electrolysis system
[DE82-004806] p 88 N83-17323
HYFIRE A Tokamak/high-temperature electrolysis system
[DE82-013851] p 90 N83-23173
- CHIANG, C. J.**
Thermal-receiver designs for line-focus solar collectors
[DE82-012067] p 82 N83-22777
- CHIBUYE, T.**
Properties of oxidized copper surfaces for solar applications I
p 54 A83-29512
- CHIGIER, N.**
Spray combustion processes - A review
[ASME PAPER 82-WA/HT-86] p 93 A83-25691
- CHILDERS, C. M.**
Design and development of monolithic acrylic Fresnel lenses for use in point-focus PV systems
[DE82-007554] p 72 N83-20768
- CHINITZ, W.**
Using a global hydrogen-air combustion model in turbulent reacting flow calculations
p 86 A83-24667
- CHOCKIE, A. D.**
Pacific Northwest biomass as an energy resource
[DE82-005804] p 110 N83-18047
- CHOUDHURY, C.**
High temperature degradation in cobalt oxide selective absorber
p 53 A83-28942
- CHOW, M. L.**
Municipal-solid-waste biconversion technologies
[DE83-000263] p 100 N83-16893
- CHRISTENSEN, W. D.**
The Second Conference on the Environmental Chemistry of Hydrazine Fuels
[AD-A121324] p 13 N83-17731
- CHUNG, J. N.**
Characteristics of coal/light hydrocarbon slurries in spray combustion
[DE82-006294] p 102 N83-17639
- CILIBERTI, D. F.**
Gas characterization from fluidized-bed coal gasification
[DE82-012396] p 138 N83-22357
- CIMINESI, F. J.**
Geotoxic materials in the surface environment
[DE82-005855] p 23 N83-19333
- CIRANNY, S.**
Initial utility experience with cluster of three Mod-2 wind turbine systems
p 173 N83-19268
- CLAAR, T. D.**
High-temperature composite latent/sensible heat storage
[DE82-010396] p 62 N83-18063
- CLARIDGE, D. E.**
Comparison of heat pump water heaters and solar domestic water heaters
[DE82-006117] p 61 N83-18046
- CLARK, E. J.**
Solar energy systems Standards for screening plastic containment materials
[PB82-242454] p 62 N83-18921
- CLAUSING, A. M.**
Convective losses from cavity solar receivers - Comparisons between analytical predictions and experimental results
p 42 A83-23881
- CLAXTON, L.**
Short-Term Bioassays in the Analysis of Complex Environmental Mixtures 2
[PB82-233172] p 23 N83-19420
- CLAY, R. G.**
Project DEEP STEAM
[DE82-010945] p 111 N83-18078
- CLAYTON, M.**
A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas
[DE83-004095] p 135 N83-21686
- CLAYTON, M. E.**
Solar-energy treatment of ceramic tiles
[DE83-000147] p 65 N83-19296
- CLEWELL, H. J., III**
Ground contamination by fuel jettisoned from aircraft in flight
p 1 A83-24041
- CLIFF, E. M.**
An on-board near-optimal climb-dash energy management
[NASA-CR-169755] p 4 N83-16329
- CLIFFORD, J. E.**
Study of battery accelerated-testing techniques
[DE82-017125] p 198 N83-22834
- CLIFTON, R. J.**
Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures
[AD-A113883] p 72 N83-20802
- CLINE, J. D.**
Dissolved methane concentrations in the southeast Bering Sea, 1980 and 1981
[PB83-112433] p 29 N83-20525
- CNOBLOCH, H.**
Redox ion flow cell for solar energy storage
p 54 A83-29407
- COBLE, C. G.**
Economic and engineering evaluation of plant oils as a diesel fuel
[DE83-900805] p 141 N83-22464
Ethanol production in small- to medium-size facilities
[DE83-900875] p 146 N83-22807
- COHEN, J. J.**
Geotoxic materials in the surface environment
[DE82-005855] p 23 N83-19333
- COHEN, S.**
Overview of fusion reactor safety
[DE82-005951] p 166 N83-17331
- COLARUSSO, J. M.**
The development of solar-assisted gas-fired appliances, phase 2
[PB82-231663] p 66 N83-19312
- COLKET, M. B.**
Experimental study of the thermal stability of hydrocarbon fuels
[NASA-CR-168027] p 105 N83-17728
- COLLINS, E., JR.**
High production shuttle car system for coal mines
[NASA-CASE-NPO-15949-1] p 187 N83-20155
- COLLINS, J. J.**
Biostatistics and health impacts of energy technologies
p 36 N83-22962
- COLLINS, J. L.**
Experience and assessment of the DOE/NASA Mod-1 2000 kW wind turbine generator at Boone, North Carolina
p 172 N83-19257
- COMBS, L. P.**
Partial liquefaction of coal by flash hydrolysis
[DE83-001145] p 126 N83-21077
Partial liquefaction of coal by flash hydrolysis, phase 4
[DE83-002167] p 127 N83-21085
- COMOLLI, A. G.**
Catalytic evaluation for H-coal
[DE82-014457] p 138 N83-22355
- CONNELL, J. R.**
The wake of the MOD-0A1 wind turbine at two rotor diameters downwind on December 3, 1981
[DE83-003305] p 180 N83-21622
- COOK, F. B.**
Research, development and demonstration of an advanced actuated heat pump
[PB82-254590] p 164 N83-16932
- COOKE-YARBOROUGH, E. H.**
A way to relax the dimensional tolerance requirements of clearance regenerators
p 158 A83-27286
- COOPER, R. C.**
Environmental quality research Fate of toxic jet fuel components in aquatic systems
[AD-A122548] p 30 N83-21168
- COPELAND, R. J.**
Use of parabolic trough collectors for residential/light commercial solar cooling systems
p 48 A83-27245
High-temperature molten salt solar thermal systems
p 51 A83-27317
- COPPA, A. P.**
Recent advances in composite flywheel containment design technology
p 189 A83-27302
Energy-storage-flywheel housing-design-concept development
[DE82-014494] p 196 N83-21574
- COPPIN, P. A. W.**
Design and standardization of meteorological measurements for wind energy converting systems
[BMFT-FB-T-82-168] p 168 N83-18172
- COQUAT, J. A.**
High-temperature geothermal cableheads
[DE82-005864] p 117 N83-19302
- COROTIS, R. B.**
Simulation of wind-speed time series for wind-energy conversion analysis
[DE83-000043] p 165 N83-17026
Assessing the representativeness of wind data for wind turbine site evaluation
p 116 N83-19239
- CORRIGAN, R. D.**
Fixed pitch rotor performance of large horizontal axis wind turbines
p 169 N83-19233
Stall induced instability of a teetered rotor
p 169 N83-19234
Free yaw performance of the Mod-0 large horizontal axis 100 kW wind turbine
p 170 N83-19235
- COTTON, F. O.**
Waste lubricating oil An annotated review, 1982 revision
[DE83-001439] p 30 N83-21156
- COUNCE, D.**
Geothermal data for 95 thermal and nonthermal waters of the Valles Caldera, southern Jemez Mountains region, New Mexico
[DE82-017397] p 130 N83-21496
- COURIER, K.**
Putting renewable energy to work in cities
[DE82-016178] p 27 N83-20427
- COURT, K. E.**
Fuel-cell-propelled submergence-tanker-system study
[DE82-015149] p 183 N83-22827
- COUTO, H. D. S.**
Ignition technique for conventional motors by high energy spark
[INPE-2645-TDL/116] p 142 N83-22594
- COUTTS, J. T.**
Effect of grain boundaries on the minority carrier diffusion length in InP solar cells
p 40 A83-22908
- COVEY, R. R.**
Potential fuel savings through improved airframe maintenance
p 11 N83-17456
- COX, C. H.**
Photovoltaic 1-5 curve measurement techniques
[DE83-000447] p 80 N83-22534
- CRABTREE, L.**
Improved thermophotovoltaic power system
p 46 A83-27139
- CRABTREE, W. L.**
Cassegrainian concentrator solar array exploratory development module
p 49 A83-27250
- CRAIG, S.**
Effect of argon pressure on the optical properties of sputtered solar selective surfaces
p 40 A83-22620
- CRAMER, M. A.**
Comparative report Performance of solar hot-water systems, 1980 - 1981
[DE83-000069] p 56 N83-16889
- CRANE, L.**
Energy-efficient technology Advancing US competitiveness and productivity
[GPO-98-637] p 25 N83-20371
- CRAVEN, H. H., JR.**
Fuel conservation techniques in jet transport aircraft operations
p 12 N83-17463
- CRAWFORD, J.**
Sealed mini-nickel cadmium battery charging techniques, technical investigation report
[AD-A119826] p 192 N83-16860
- CREMEANS, A. H.**
An analysis of the cost/performance characteristics of passive solar materials and components
p 49 A83-27247
Thermal performance case studies for residential solar heating and cooling systems
[PB82-260100] p 59 N83-16940
- CRESSWELL, D. L.**
A system of hydrogen-powered vehicles with liquid organic hydrides
p 88 A83-27340
- CRETCHER, C. K.**
Load following impacts of a large wind farm on an interconnected electric utility system
p 151 A83-22675
- CROCKER, J. G.**
Overview of fusion reactor safety
[DE82-005951] p 166 N83-17331
- CROUCH, W. B.**
Enriched-air and oxygen gasification of Illinois No. 6 coal in a Texaco coal-gasification unit
[DE82-903133] p 139 N83-22362
- CROWE, C. T.**
Characteristics of coal/light hydrocarbon slurries in spray combustion
[DE82-006294] p 102 N83-17639

- CTVRTNICEK, T. E.**
Oil/refuse homogenization. An approach to combustion of refuse in existing oil-fired boilers
[DE82-011848] p 138 N83-22353
- CULL, R. C.**
Performance degradation and cleaning of photovoltaic arrays p 48 A83-27236
- CULLINGFORD, H. S.**
A data-gathering method for use in modeling energy research, development and demonstration programs
[DE82-006153] p 16 N83-18040
- CUMMINGS, R. G.**
Use of hot-dry-rock geothermal resources for space heating. A case study
[DE83-002947] p 135 N83-21636
- CUNNINGHAM, B.**
The structure of 110 tilt boundaries in large area solar silicon
[NASA-CR-170204] p 81 N83-22744
- CUNTZE, R.**
Construction, testing and development of large wind energy facilities
[NASA-TM-76933] p 163 N83-16855
- CURIO, A. R.**
Combustion of solvent-refined coal in a 100 HP firetube boiler
[DE82-007670] p 103 N83-17640
- CURTIS, H.**
General aviation airplane fuel economy system model
p 20 N83-18647
- CURTISS, J. R. B.**
Biostatistics and health impacts of energy technologies p 36 N83-22962
- CUTRONE, M.**
Fuel quality-processing study. Volume 2. Literature survey
[NASA-CR-165326-VOL-2] p 143 N83-22751
- CVIJANOVIC, D.**
Tectonic elements registered on the Landsat imagery in area of Yugoslavia and their practical meaning
p 91 A83-21945
- CZANDERNA, A. W.**
Stability of reflectors with polymenc coatings
[DE82-007774] p 60 N83-17723
- D**
- DACIERNO, J.**
Systems analysis of hydrogen supplementation in natural gas pipelines
[DE82-006933] p 89 N83-17740
- DAGINCOURT, C.**
Direct-contact air/molten salt heat exchange for solar thermal systems p 47 A83-27234
- DAHLGREN, R. C.**
Parametric investigations and other related studies of energy storage type capacitors
[DE83-003426] p 197 N83-22785
- DAILY, W. D.**
The HFEM monitoring of coal gasification. Rawlins, Wyoming
[DE82-013801] p 142 N83-22466
- DALE, B. E.**
Methanol production from fermentor off-gases
[DE83-005011] p 145 N83-22793
- DALE, J. D.**
Rationale for advances in the technology of I C engines
[DE82-000264] p 14 N83-17886
A rationale for advances in the technology of I C engines
[DE82-005840] p 14 N83-17889
- DALEN, M.**
A study of emissions from light duty vehicles in San Antonio, Texas, year 2
[PB83 124743] p 36 N83-22867
- DALESSIO, G.**
National implications of high solar and biomass energy growth. A technology assessment of solar energy systems. The TASE Project
[DE83-004935] p 34 N83-21638
- DANDREA, R. F., JR.**
Uranium hydrogeochemical and stream sediment reconnaissance of the St Michael NTMS quadrangle, Alaska
[DE82-009999] p 99 N83-16844
Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska
[DE82-009666] p 115 N83-19196
Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197
- PLTSYM** A FORTRAN computer system to plot Canadian symbol location maps for hydrogeochemical and stream-sediment reconnaissance data
[DE83-000764] p 123 N83-20337
- DANIEL, S. R.**
Studies of the mechanisms of turbine fuel instability
[NASA-CR-167963] p 114 N83-18924
- DANIELS, A.**
Automated installation methods for photovoltaic arrays
[DE83-004272] p 82 N83-22796
- DANIELS, E. J.**
Hydrogen use in a rural Alaskan community
[DE83-000568] p 90 N83-22813
- DANIELS, K. L.**
Environmetrics of synfuels. Part 4. Project Results Tracking System (PRTS)
[DE82-011444] p 10 N83-16977
Development of statistical databases for toxicological studies
[DE82-005196] p 10 N83-17067
Statistical database management for ecosystem-effects analysis
[DE82-005199] p 18 N83-18104
Cartographic evaluation of environmental-management strategies
[DE82-009828] p 35 N83-22702
- DANIELSON, R.**
Environmental quality research. Fate of toxic jet fuel components in aquatic systems
[AD-A122548] p 30 N83-21168
- DANKO, E. A.**
Investigation of methanol as a boiler fuel for electric-power generation
[DE82-905495] p 97 N83-16560
- DARROW, A. D.**
Use of inorganic materials for phosphorescent concentrating solar cells
[DE83-002860] p 83 N83-22799
- DAS, R.**
Application of electrochemical energy storage in solar thermal electric generation systems p 47 A83-27179
- DAVENPORT, R. L.**
Performance and stability of the mist-lift process for open-cycle OTEC
[DE82-010881] p 175 N83-20403
Design approaches for solar industrial process-heat systems. Nontracking and line-focus collector technologies
[DE83-003339] p 79 N83-21620
- DAVIS, A.**
Relationships between coal constitution, thermoplastic properties and liquefaction behavior of coals and vitrinite concentrates from the lower Kittanning seam, part 1
[DE82-012848] p 118 N83-19860
- DAVIS, F.**
OTEC plants for today's island market
p 156 A83-27227
- DAVIS, H. G.**
Direct liquefaction of biomass. Results from operation of continuous bench scale unit in liquefaction of water slurries of Douglas fir wood
[DE82-015703] p 124 N83-20414
- DAWLEY, L. J.**
Municipal-solid-waste biconversion technologies
[DE83-000263] p 100 N83-16893
Design, construction, operation and costs of a modern small-scale fuel-alcohol plant
[DE82-011019] p 107 N83-17754
- DAY, A. C.**
Improved thermophotovoltaic power system
p 46 A83-27139
- DE VOS, A.**
The fill factor of a solar cell from a mathematical point of view
p 52 A83-27986
- DEADRIK, F. J.**
The HFEM monitoring of coal gasification. Rawlins, Wyoming
[DE82-013801] p 142 N83-22466
- DEAVER, F. K.**
Analysis of temperature data from Martin Marietta solar photovoltaic array
[DE82-014258] p 69 N83-20389
- DEB, S. K.**
Status of photovoltaic materials and process technologies
p 38 A83-20435
- DEBUYS, W. E., JR.**
Future landscapes of the Colorado plateau. Impacts of energy development
[DE83-900473] p 34 N83-21666
- DECKER, D. K.**
Development of management technology for large power systems
p 46 A83-27147
- DEDUCK, P. F.**
Assessment of distributed photovoltaic electric-power systems
[DE83-900531] p 75 N83-21558
- Assessment of distributed photovoltaic electric-power systems**
[DE83-900566] p 187 N83-22788
- DELAMETER, W. R.**
Testing and evaluation of second-generation heliostat mirror modules
[DE82-007934] p 77 N83-21582
- DELOME, C.**
Mesoscale mapping of available hourly solar irradiance by use of data collected by 'Meteosat'
p 43 A83-24633
- DELSEY, J.**
Motor-fuels for road vehicles
[REPT-24] p 140 N83-22440
- DEMCHENKO, F. N.**
Possibilities of improving degree of perfection and effectiveness of use of secondary thermal energy resources
[BLL-M-26859-(5825 4)] p 143 N83-22738
- DEMIDOV, S. A.**
An improved portable thermoradiometer /TRM/ for measuring the relative emissivity of solids at room temperature
p 39 A83-20959
- DEMUTH, O. J.**
Analyses of mixed hydrocarbon binary thermodynamic cycles for moderate temperature geothermal resources
[DE82-006272] p 164 N83-16904
- DEN BOER, W.**
Computer simulation of the optical behaviour of amorphous silicon solar cells
p 51 A83-27979
- DENIS, J.**
Reactive sputtered Ta2O5 antireflection coatings
p 52 A83-27984
- DEUTSCH, W. J.**
Guidelines for sampling and analyzing solutions for aquifer thermal-energy-storage systems
[DE83-001852] p 10 N83-16973
- DEVAN, J. H.**
Thermal-convection-loop study of the corrosion of Fe-Ni-Cr alloys by molten NaNO₃/sub 3-KNO₃/sub 3
[DE83-004228] p 80 N83-22407
- DEVINE, N.**
Biostatistics and health impacts of energy technologies p 36 N83-22962
- DEVINE, W. D., JR.**
Electric home heating. Substitution for oil and gas
[DE82-013762] p 133 N83-21581
- DEWALLE, F. B.**
Effects of petroleum on selected uniform substrates. A feasibility study
[PB82-255084] p 10 N83-16985
- DEWINKEL, C. C.**
An assessment of wind characteristics and wind energy conversion systems for electric utilities
[PB82-258971] p 165 N83-16935
- DEWINTER, F.**
Development of an advanced solar augmented water heater (for single family home applications)
[PB83-119610] p 84 N83-22842
- DEYOUNG, R.**
Fuel-composition and -vaporization effects on combustion-chamber deposits
[DE82-012576] p 104 N83-17670
- DHARIWAL, S. R.**
Al-Si peaked Schottky barriers p 40 A83-22903
- DHAVE, R.**
General review of wind engineering problems
p 114 N83-18944
- DHOORE, F.**
High efficiency p+/ -n-n/ + / back-surface field silicon solar cells with very large short-circuit current densities
p 41 A83-22913
- DIAZ, R. J.**
Examination of tidal flats. Volume 3. Evaluation methodology
[PB83-131805] p 148 N83-22949
- DIEBOLD, J. P.**
Entrained flow, ablative fast pyrolysis of biomass
[DE82-005791] p 113 N83-18875
- DIEHL, K. C.**
Economic and engineering evaluation of plant oils as a diesel fuel
[DE83-900805] p 141 N83-22464
- DIKE, G. A.**
Exterior insulating shutter final prototype design
[DE83-004520] p 33 N83-21616
- DILLARD, P. A.**
Lightweight solar array blanket tooling, laser welding and cover process technology
[NASA-CR-170209] p 81 N83-22741
- DILLINGHAM, E. W.**
Enriched-air and oxygen gasification of Illinois No. 6 coal in a Texaco coal-gasification unit
[DE82-903133] p 139 N83-22362

DVALENTIN, E.

Development of the WTS-4 wind turbine design
p 159 A83-27323

DODGE, L. G.

Fuel property effects on diesel engine and gas turbine combustor performance
[AD-A120879] p 175 N83-20161

DOERING, E.

Solar energy plant as a complement to a conventional heating system Measurement of the storage and consumption of solar energy
[PB82-255209] p 59 N83-16946

DOERR, H.

Desulphurization of solid fuels in power stations by superconductive magnets
[BLL-CE-TRANS-7855-(9022 09)] p 125 N83-21051

DOHERTY, T. J.

Factors affecting storage of compressed air in solution mined salt cavities p 191 A83-27311

Issues affecting storage of compressed air in solution-mined salt cavities
[DE83-002017] p 197 N83-22804

Aquifer compressed-air field experiment at Pittsfield, Illinois
[DE83-002057] p 198 N83-22805

DOLOCAN, V.

New materials for solar cells - Tandem cells
p 45 A83-26882

DOMKE, A. E.

Computerized engine and airplane performance monitoring programs p 12 N83-17465

DON, E.

Effect of grain boundaries on the minority carrier diffusion length in InP solar cells p 40 A83-22908

DONAKOWSKI, T. D.

Vehicle conversion to hybrid gasoline/alternative fuel operation
[NASA-CR-169911] p 115 N83-19216

Hydrogen use in a rural Alaskan community
[DE83-000568] p 90 N83-22813

DONALDSON, A. B.

Project DEEP STEAM
[DE82-010945] p 111 N83-18078

DONOHUE, H. F.

Solar-collector silicon hose life test
[DE83-002236] p 83 N83-22798

DORAN, J. C.

Inherent uncertainties in meteorological parameters for wind turbine design p 171 N83-19253

Comparison of model and observations of the wake of a MOD-OA wind turbine
[DE83-002882] p 180 N83-21633

Vertical extrapolations of wind speed
[DE83-000944] p 136 N83-21723

DORNFIELD, S. S.

Toxicology of coal gasification Chemical characterization p 148 N83-22960

DOSS, E. D.

MHD channel electrical boundary-layer theory and applications p 151 A83-23131

DOUGHERTY, D. A.

Design approaches for solar industrial process-heat systems Nontracking and line-focus collector technologies
[DE83-003339] p 79 N83-21620

DOUGHTY, R. W.

Future landscapes of the Colorado plateau Impacts of energy development
[DE83-900473] p 34 N83-21666

DOUGLAS, R. R.

Conceptual design of the 7 megawatt Mod-5B wind turbine generator p 173 N83-19272

DOWNING, R. A.

Investigation of the geothermal potential of the UK The Southampton (Western Esplanade) geothermal well A preliminary assessment of the resource p 109 N83-18029

DOWNING, R. G.

Results of the 1982 NASA/JPL balloon flight solar cell calibration program
[NASA-CR-170123] p 72 N83-21510

DRACHENIN, E. A.

Possibilities of improving degree of perfection and effectiveness of use of secondary thermal energy resources
[BLL-M-26859-(5825 4)] p 143 N83-22738

DRAKE, J. M.

Light transport in planar luminescent solar concentrators - The role of DCM self-absorption p 39 A83-22619

DRAKE, R. H.

Use of hot-dry-rock geothermal resources for space heating A case study
[DE83-002947] p 135 N83-21636

DREES, H. M.

ASU/Pinson 1-kilowatt high-reliability wind system development. Phase 1 Design and analysis
[DE82-018128] p 180 N83-21602

DRESSLER, R. T.

Design and fabrication of a prototype system for photovoltaic residences in the Northeast
[DE82-022210] p 55 N83-16872

DROST, M. K.

Evaluation of ammonia as a working fluid for a wet/dry-cooled binary geothermal plant
[DE83-002895] p 135 N83-21631

DUBOIS, Y.

Energy generating and storing method for space application p 177 N83-21021

DUDLEY, V. E.

Performance testing of the Acurex solar collector model 3001-03
[DE82-013389] p 77 N83-21603

DUDUKOVIC, M. P.

Theoretical and experimental studies of fixed-bed coal gasification reactors
[DE82-009515] p 104 N83-17655

DUEBALL, I. W.

Coal-waste artificial-reef program, phase 3 Volume 2 Comprehensive report
[DE82-005591] p 8 N83-16954

DUFFIE, J. A.

f-Chart - Predictions and measurements p 42 A83-23880

DUGUNDJI, J.

Some experiments on Yaw stability of wind turbines with various coning angles
[NASA-CR-168108] p 181 N83-22740

Development of methodology for horizontal axis wind turbine dynamic analysis
[NASA-CR-168110] p 181 N83-22747

DUNN, B. D.

Evaluation of various solar-cell-to-interconnector welds by means of scanning laser acoustic microscopy and metallography
[ESA-STM-225] p 73 N83-21514

DUTTON, J. A.

Spectra over complex terrain in the surface layer
[DE83-000502] p 102 N83-17027

DUVAL, V. L.

Cleanup of groundwater contaminated by underground coal gasification
[DE82-005824] p 19 N83-18118

DUVALL, J. J.

Simulated in situ retorting of oil-shale in a controlled-state retort 3 Dynamic oil film thickness on partially retorted and unretorted shale
[DE82-011107] p 108 N83-18008

DZHAIBAEV, A. D.

A physiological and hygienic evaluation of the work regime of operators who are working in current energy production in Kirghizia p 4 A83-28765

E

EAKIN, D. E.

Collection, transportation, and storage of biomass residues in the Pacific Northwest
[DE82-004737] p 100 N83-16887

ECKERLIN, P.

Investigation and development of systems for the storage of thermal energy in the temperature range from -25 deg C to +150 deg C
[PB82-255258] p 193 N83-16949

EDDLEMAN, H.

Microorganisms for fermentation of crop residues
[DE82-006912] p 102 N83-17051

EDELMAN, R. B.

Study of net soot formation in hydrocarbon reforming for hydrogen fuel cells
[DE83-001046] p 90 N83-22352

Review of alternative fuels data bases
[NASA-CR-170203] p 140 N83-22439

EDELSTEIN, R. H.

National forecast for geothermal resource exploration and development with techniques for policy analysis and resource assessment
[DE82-014641] p 133 N83-21588

EDENBURN, M. W.

Photovoltaic-concentrator technology in the USA
[DE82-016399] p 68 N83-20387

Shading analysis of a photovoltaic-cell string illuminated by a parabolic-trough concentrator
[DE83-002646] p 74 N83-21537

EDER, O. J.

Porous metal hydride compacts - Preparation, properties and use p 88 A83-27338

EDGAR, D. E.

Alaskan coal Resources and developmental constraints
[DE83-000860] p 130 N83-21494

EDGAR, R. M.

Solar furnace for flux gage calibration and thermal-effects testing
[DE82-005769] p 62 N83-18062

EDMONDS, W. M.

Investigation of the geothermal potential of the UK The Southampton (Western Esplanade) geothermal well A preliminary assessment of the resource p 109 N83-18029

EDSON, W. A.

Review of Thawtron device for thawing frozen coal
[DE82-903145] p 123 N83-20330

EDWARDES, P.

Geothermal energy Opportunities for California commerce, phase 1 report
[DE82-009121] p 110 N83-18066

EGAN, B. Z.

Magnesia spray absorption for the removal of SO₂ from flue gas
[DE82-013443] p 28 N83-20456

EGGERS, A. G.

The MOD-OA 200 kilowatt wind turbine generator design and analysis report
[NASA-CR-165127] p 163 N83-16859

EGGERS, G.

Technology of elevated voltage solar arrays Key items test and evaluation Part 2 Simulated LEO-plasma tests
[ESA-CR(P)-1646] p 73 N83-21513

EGGERT, W. S.

Design and evaluation of low cost blades for large wind driven generating systems p 170 N83-19244

EGGERT, W. S., JR.

Design and evaluation of low-cost stainless steel fiberglass foam blades for large wind driven generating systems
[NASA-CR-165491] p 169 N83-19226

EID, J. C.

Development and demonstration of a reverse-osmosis energy-recovery device
[PB83-108605] p 140 N83-22380

EIFERT, R. W.

High-temperature geothermal cableheads
[DE82-005864] p 117 N83-19302

EISCH, J. J.

Desulfurization with transition-metal catalysis
[DE82-013964] p 118 N83-19853

Desulfurization with transition metal catalysts
[DE83-003062] p 126 N83-21071

EISENHAWER, S. W.

Project DEEP STEAM
[DE82-010945] p 111 N83-18078

EISENLOHR, K. H.

Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels
[PB82-255167] p 96 N83-16459

EKMANN, J. M.

Test report on the combustion of PERC and LBL wood oils
[DE82-004485] p 95 N83-16429

EL BANHAWY, Y.

Premixed, turbulent combustion of a sudden-expansion flow p 92 A83-23748

EL OSERY, I. A.

Theory of the computer code RET 1 for the calculation of space-time dependent temperature and composition properties of metal hydride hydrogen storage beds p 88 A83-27337

EL-SHABAN, I.

The effect of the melt heat treatment time on the properties of lithium lubricants with additives p 94 A83-26921

ELDERS, W. A.

Oxygen isotope exchange in rocks and minerals from the Cerro Prieto geothermal system Indicators of temperature distribution and fluid flow
[DE82-001077] p 100 N83-16907

ELLIOT, D. L.

World-wide resource assessment
[DE82-004272] p 102 N83-17024

ELLIOTT, D. C.

Bench scale research in biomass direct liquefaction
[DE82-005228] p 100 N83-16905

ELLIOTT, D. L.

Putting wind resource atlases to use p 115 N83-19237

ELLIS, W. E.

Thermal control - Heat buses will operate like a public utility p 184 A83-24358

- ELSTON, M. J.**
Further development of the fluidyne liquid-piston engine p 156 A83-27275
- EMIGH, S. G.**
Design of hydraulic output unit for 15 kW free-piston Stirling engine p 157 A83-27277
Development of a quiet Stirling cycle multi-fuel engine for electric power generation [AD-A121033] p 174 N83-19278
- EMSPERGER, W.**
Power plant concepts using new coal conversion technologies [BMFT-FB-T-82-031] p 131 N83-21506
- ENBAR, E.**
Rankine/Rankine cycle gas-fired heat pump [PB82-254640] p 165 N83-16944
- ENDO, M.**
Status report on sulfur iodine thermochemical water-splitting cycle [DE82-007164] p 88 N83-17633
- ENGEBECK, L.**
Swedish national and local government programs for conservation of energy in buildings [PB82-246752] p 22 N83-19307
- ENGELHARDT, R.**
Power plant concepts using new coal conversion technologies [BMFT-FB-T-82-031] p 131 N83-21506
- ENGLER, C. R.**
Economic and engineering evaluation of plant oils as a diesel fuel [DE83-900805] p 141 N83-22464
- ENGLIN, B. A.**
The properties of fuel fractions obtained by the hydrogenation of Kansk-Achinsk coal p 94 A83-26920
- EPPEL, D.**
Simulation of air-pollution propagation resulting from at-sea incineration wastes [DE82-902297] p 10 N83-16979
- EPPERLY, W. R.**
EDS coal-liquefaction process development Phase 5 EDS product quality [DE83-002226] p 117 N83-19827
- ERDMAN, A. G.**
Design of plywood and paper flywheel rotors [DE83-002276] p 195 N83-20430
- ERICSSON, C.**
Swedish national and local government programs for conservation of energy in buildings [PB82-246752] p 22 N83-19307
- ERMOLAEV, V. N.**
Utilization of secondary energy resources at Magnitogorsk Metallurgical Combine [BLL-M-26856-(5828 4)] p 131 N83-21502
- ERNST, D. M.**
Long titanium heat pipes for high-temperature space radiators p 185 A83-27127
- ERSHAGHI, I.**
Lithology and hydrothermal alteration determination from well logs for the Cerro Prieto Wells, Mexico [DE82-004677] p 101 N83-17000
- ESTABROOK, K. G.**
Laser-plasma interaction experiments at laser wavelengths of 1.064 micron, 0.532 micron and 0.355 micron [DE82-013992] p 175 N83-20114
- ETNIER, E. L.**
Health and safety issues of alternate energy systems [DE82-002918] p 9 N83-16959
- EUBANKS, J. P.**
Experimental techniques for the study of photosynthetic water splitting [DE82-003974] p 89 N83-17668
- EVANS, L. B.**
Coal pyrolysis by hot solids from a fluidized-bed combustor [DE83-003344] p 117 N83-19829
- EVERINGHAM, J.**
A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas [DE83-004095] p 135 N83-21686
- EWELL, R.**
Thermoelectric conversion for space nuclear power p 155 A83-27222

F

- FAIN, D.**
Monitoring well systems in geothermal areas [DE82-012770] p 133 N83-21586
- FAIRBANKS, J. W.**
18:1 pressure ratio axial/centrifugal compressor demonstration program p 161 A83-29013
- FAIRCHILD, P. D.**
Heat-activated heat-pump development and potential application of Stirling-engine technology [DE83-002134] p 183 N83-22817
- FALCONE, P. K.**
Evaluation and application of solid thermal energy carriers in a high temperature solar central receiver system p 47 A83-27235
- FALK, A. Y.**
Partial liquefaction of coal by flash hydropyrolysis [DE83-001145] p 126 N83-21077
- FALK, R.**
Review and evaluation of automotive fuel conservation technologies [PB83-101139] p 30 N83-20844
- FALLON, P. T.**
Flash pyrolysis of biomass with reactive and non-reactive gases [DE83-001850] p 137 N83-22336
- FAN, H. S. L.**
Aircraft towing feasibility study p 11 N83-17458
- FANSLAW, G. E.**
The response of solar cells to microwave radiation [AD-A121813] p 64 N83-19279
- FARLEY, K. M.**
Marine biomass New York state site and species study compositional analysis and systems studies [PB83-126078] p 142 N83-22470
- FARMAYAN, W. F.**
Design strategy for the combustion of coal-derived liquid fuels [DE82-905496] p 95 N83-16444
- FARMER, R. C.**
Study of net soot formation in hydrocarbon reforming for hydrogen fuel cells [DE83-001046] p 90 N83-22352
- FARMER, R. F.**
Shock initiated ignition in heptane-oxygen-argon mixtures p 93 A83-26198
- FARNUM, B. W.**
Liquefaction behavior of a Canadian subbituminous coal in comparison with several US lignites and subbituminous coals [DE82-021976] p 146 N83-22824
- FARNUM, S. A.**
Liquefaction behavior of a Canadian subbituminous coal in comparison with several US lignites and subbituminous coals [DE82-021976] p 146 N83-22824
- FARQUHAR, O. C.**
Geotechnical basis for underground energy storage in hard rock [DE82-903307] p 198 N83-22836
- FARRELL, M. P.**
Environmetrics of synfuels Part 4 Project Results Tracking System (PRTS) [DE82-011444] p 10 N83-16977
Cartographic evaluation of environmental-management strategies [DE82-009828] p 35 N83-22702
- FARRINGTON, J. W.**
Petroleum contamination Quantification and passive tagging in organisms and sediments [PB82-254087] p 113 N83-18880
- FARSTAD, A. J.**
Mine personnel locator and mine activity controller [PB82-235979] p 200 N83-19315
- FASSBENDER, A. G.**
Energy efficient industrial technology in Europe A compendium [PB83-102327] p 28 N83-20442
- FASSBENDER, L. L.**
User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 1 Main text [DE82-022512] p 99 N83-16865
User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 2 Appendices [DE82-022511] p 99 N83-16866
- FAUVEL, R.**
An isothermal second-order Ringbom-Stirling engine computer program p 157 A83-27281
- FEDERER, J. I.**
Selecting and testing oxygen-measuring systems for fluidized-bed combustors [DE83-005987] p 128 N83-21089
- FEDOROV, V. I.**
A method for producing heat pipes for cooling semiconductor photovoltaic cells and the heat pipe characteristics p 52 A83-28366
- FEIMAN, V.**
Development of a high capacity toroidal Ni/Cd cell [NASA-CR-169945] p 174 N83-19273
- FELDER, R. M.**
Rates and equilibria of devolatilization and trace element evolution in coal pyrolysis [PB82-260944] p 96 N83-16460
- FELDMAN, K. T., JR.**
Potential for domestic heat recovery [DE82-901395] p 15 N83-18037
Additional testing of the passive heat-pipe-cooled solar photovoltaic receiver [DE-83-004474] p 78 N83-21615
- FELKER, D. L.**
Study of the electrowinning of copper using a fluidized-bed electrochemical reactor [DE83-004854] p 181 N83-22404
- FELKER, L. K.**
Magnesia spray absorption for the removal of SO₂ from flue gas [DE82-013443] p 28 N83-20456
- FERGUSON, D. R.**
A practical economic criterion for fuel conservation p 12 N83-17468
- FERM, J. C.**
A study of the United States coal resources [NASA-CR-169792] p 101 N83-16993
- FERRARO, V. D.**
Coordination of the onsite fuel cell program [PB83-119545] p 184 N83-22839
- FERRELL, J. K.**
Rates and equilibria of devolatilization and trace element evolution in coal pyrolysis [PB82-260944] p 96 N83-16460
- FICHTE, R.**
Replacement of lumpy chrome ore by agglomerated ore concentrates and lowering of specific power consumption and improvement of Cr yield by means of improved slag composition in the production of HC ferrochrome [BMFT-FB-T-82-084] p 7 N83-16929
- FIGUEROA, C.**
Direct liquefaction of biomass Results from operation of continuous bench scale unit in liquefaction of water slimes of Douglas fir wood [DE82-015703] p 124 N83-20414
- FILLO, J. A.**
HYFIRE A Tokamak/high-temperature electrolysis system [DE82-004806] p 88 N83-17323
HYFIRE A Tokamak/high-temperature electrolysis system [DE82-013851] p 90 N83-23173
- FILLO, J. P.**
Formation/decomposition of condensable hydrocarbons during the gasification of coal [DE82-014493] p 119 N83-19866
- FINAN, W. F.**
National forecast for geothermal resource exploration and development with techniques for policy analysis and resource assessment [DE82-014641] p 133 N83-21588
- FINCH, S. J.**
Model simplification to examine the interrelationships between coal, gas and oil use [DE82-007816] p 110 N83-18061
- FINEGOLD, J. G.**
Reformed methanol [DE83-002096] p 129 N83-21178
- FINNERAN, K.**
Solar technology - A whether report p 43 A83-25124
Putting renewable energy to work in cities [DE82-016178] p 27 N83-20427
- FIORUCCI, L. C.**
Manufacture, distribution, and handling of nitrate salts for solar-thermal applications [DE83-003317] p 79 N83-21625
- FISHER, P. W.**
Modeling and evaluation of designs for solid hydrogen storage beds p 87 A83-27333
- FISHER, R.**
Fossil-energy [DE83-003817] p 124 N83-20383
- FISK, W. J.**
Residential air-to-air heat exchangers A study of the ventilation efficiencies of wall- or window-mounted units [DE83-004752] p 33 N83-21617
- FITZPATRICK, G. O.**
Direct conversion nuclear reactor space power systems p 158 A83-27296

FLAIM, T.

FLAIM, T.

Wind system value analysis for electric utilities A comparison of four methods [DE82-006963] p 164 N83-16883

FLANAGAN, R. C.

Program overview and diesel/flywheel hybrid power train design - Fibre composite flywheel development program for road vehicle applications p 190 A83-27306
Fibre composite rotor selection and design / Fibre composite flywheel development program for road vehicle applications/ p 190 A83-27307
Manufacture and testing of fibre composite rotor components / Fibre composite flywheel development program for road vehicle applications/ p 190 A83-27308

FLEISCHAUER, P.

Decision framework for technology choice Volume 1 A case study of one utility's coal-nuclear choice [DE82-902213] p 113 N83-18554

FLEMING, D. K.

Coal gasification for stationary gas-turbine applications [DE82-902135] p 97 N83-16553

FLOESS, J. K.

Coal pyrolysis by hot solids from a fluidized-bed combustor [DE83-003344] p 117 N83-19829

FLOOD, D. J.

The NASA program in Space Energy Conversion Research and Technology p 160 A83-27326

FONG, L.

Coal pyrolysis by hot solids from a fluidized-bed combustor [DE83-003344] p 117 N83-19829

FOOS, J. S.

Development of a high capacity toroidal Ni/Cd cell [NASA-CR-169945] p 174 N83-19273

FORD, G.

Ocean thermal-energy conversion p 152 A83-25125

FOREMAN, K. M.

Size effects in DAWT innovative wind energy system design [ASME PAPER 82-WA/SOL-20] p 153 A83-25688

FORMICA, W. J.

Long-term energy capture and the effects of optimizing wind turbine operating strategies p 171 N83-19248

FORSHEE, M.

A study of emissions from light duty vehicles in San Antonio, Texas, year 2 [PB83-124743] p 36 N83-22867

FORT, J. A.

CAESCAP A computer code for compressed-air energy-storage-plant cycle analysis [DE83-003146] p 196 N83-21528

FOTHERINGHAM, N.

Gulf coast ecological inventory user's guide and information base [DE83-900406] p 28 N83-20455

FOX, H.

Congeneration feasibility Otis Elevator Company and Polychrome Corporation [PB82-263526] p 7 N83-16942

FOX, R. L.

Project DEEP STEAM [DE82-010945] p 111 N83-18078

FRANK, A. A.

The use of mechanical energy storage in an unconventional, rough terrain vehicle p 190 A83-27309

FRANK, H.

Application of electrochemical energy storage in solar thermal electric generation systems p 47 A83-27179

FRANKLIN, H. D.

Dynamic simulation of Exxon's Catalytic Coal-Gasification process [DE82-021973] p 146 N83-22823

FRANTZ, C. E.

Reentry thermal testing of a general purpose heat source fueled clad [DE82-014125] p 184 N83-23146

FREEMAN, D.

Demonstration of modification of a gasoline spark-ignited engine to permit using ethanol as a fuel [DE83-001384] p 114 N83-19101

FRENCH, E. P.

Design of large, low-concentration-ratio solar arrays for low earth orbit applications p 49 A83-27254

FREUND, L. B.

Research on application of Arc-Plasma Spraying (APS) [DE82-015220] p 70 N83-20408

FREW, R. L.

Gulf coast ecological inventory user's guide and information base [DE83-900406] p 28 N83-20455

FROEHL, C.

Velocity measurements in an axisymmetric laminar flow using an optical technique of visualization in coherent light p 54 A83-29704

FRYBOURG, A.

Motor-fuels for road vehicles [REPT-24] p 140 N83-22440

FTHENAKIS, V.

An analysis of selected surface characteristics and latent heat storage for passive solar space heating [DE82-006932] p 61 N83-18049

FUCHIDA, K.

Sodium-sulfur battery program in Japan p 189 A83-27175

FUJITA, T.

Configuration selection study for isolated loads p 41 A83-23137
Comparison of advanced thermal and electrical storage for parabolic dish solar thermal power systems p 47 A83-27232

FUKS, I. G.

The effect of the melt heat treatment time on the properties of lithium lubricants with additives p 94 A83-26921

FULLER, H.

Design and component testing of a low-temperature waste-heat-driven refrigeration system, phases 1 and 2 [DE82-014721] p 179 N83-21571

FUQUA, D.

Liquid fossil-fuel technology [DE83-002501] p 121 N83-19937

FURMAN, E. R.

Critical research and advanced technology (CRT) support project [NASA-TM-83019] p 123 N83-20361

FURUSHO, N.

Amorphous silicon photovoltaic modules p 45 A83-26064

G

GABRIEL, D. A.

Development and implementation of dynamic methodologies for evaluating energy conservation strategies [PB82-240763] p 21 N83-19304

Development and implementation of dynamic methodologies for evaluating energy conservation strategies Executive summary [PB82-240771] p 21 N83-19305

GAENSLEN, H.

Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels [PB82-255167] p 96 N83-16459

GAFF, S. A.

Design of plywood and paper flywheel rotors [DE83-002276] p 195 N83-20430

GAINES, R.

Review and evaluation of automotive fuel conservation technologies [PB83-101139] p 30 N83-20844

GAITONDE, N. Y.

Dynamic simulation of Exxon's Catalytic Coal-Gasification process [DE82-021973] p 146 N83-22823

GALLOWAY, T. R.

A viable process for producing hydrogen synfuel using nuclear fusion heat p 87 A83-27210

GALSWORTHY, J. C.

High temperature erosion and erosion-hot corrosion of superalloys and coatings p 91 A83-21458

GANESAN, S.

Rates and equilibria of devolatilization and trace element evolution in coal pyrolysis [PB82-260944] p 96 N83-16460

GARCIA, A., III

Development of metallization process, FSA project, cell and module formation research area [NASA-CR-169902] p 63 N83-19220

GARCIA, S. R.

Uranium hydrogeochemical and stream sediment reconnaissance of the St. Michael NTMS quadrangle, Alaska [DE82-009999] p 99 N83-16844

Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska [DE82-009664] p 115 N83-19197

GARRETT-PRICE, B. A.

Overview of existing residential energy-efficiency rating systems and measuring tools [DE83-003148] p 20 N83-19289

GARRISON, M. L.

Integrated passive-solar demonstration project [DE83-900807] p 82 N83-22795
Passive-solar homes for Texas [DE83-900806] p 83 N83-22818

GARSTANG, M.

Coastal zone wind energy Part 3 A procedure to determine the wind power potential of the coastal zone [DE82-014334] p 134 N83-21598

GASS, S. I.

Oil and Gas Supply Modeling [PB82-234139] p 117 N83-19310

GATELY, D.

World oil model development [DE82-013979] p 25 N83-20334

GATES, T. E.

Geotechnical properties of PARAH0 spent shale [DE83-002633] p 136 N83-21694

GAUSSENS, P.

First results, problems of French deep gasification program p 107 N83-17765

GAY, G. T.

Vertical sampling flights in support of the 1981 ASCOT cooling tower experiments Field effort and data [DE82-014269] p 135 N83-21661

GEE, R. C.

Design approaches for solar industrial process-heat systems Nontracking and line-focus collector technologies [DE83-003339] p 79 N83-21620

GEHLISCH, K.

Large parabolic dish collectors with small gas-turbine, Stirling engine or photovoltaic power conversion systems p 160 A83-27329

GELB, A.

Hot-gas cleanup for molten-carbonate fuel cells [DE82-002500] p 163 N83-16864

GELERINTER, E.

Applications of ion beam technology [NASA-CR-169797] p 88 N83-16493

GELLINGS, C. W.

Electric system impacts of storage heating and storage water heating, part 2 [DE81-032010] p 192 N83-16863

GENENS, L.

OTEC plants for today's island market p 156 A83-27227

GEORGE, R. L.

The wake of the MOD-0A1 wind turbine at two rotor diameters downwind on December 3, 1981 [DE83-003305] p 180 N83-21622

GEORGE, W. E.

Uranium hydrogeochemical and stream sediment reconnaissance of the St. Michael NTMS quadrangle, Alaska [DE82-009999] p 99 N83-16844

Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska [DE82-009664] p 115 N83-19197

GEORGIEVA, E.

Current aspects of wind-energy utilization - Status and prospects in Bulgaria p 91 A83-22421

GERMANE, G. J.

Basic combustion and pollutant-formation processes for pulverized fuels [DE82-013773] p 29 N83-20457

GERSTENBERGER, T.

Review and evaluation of automotive fuel conservation technologies [PB83-101139] p 30 N83-20844

GESHEVA, K. A.

Chemically vapor-deposited black molybdenum films of high IR reflectance and significant solar absorptance p 44 A83-25534

GHAEMIAN, S.

Lithology and hydrothermal alteration determination from well logs for the Cerro Prieto Wells, Mexico [DE82-004677] p 101 N83-17000

GHAFFARI, H. T.

Design and construction of a demonstration residence utilizing natural thermal storage [DE82-005508] p 5 N83-16569

Thermal performance of the Brookhaven natural thermal storage house [DE82-005507] p 56 N83-16879

Instrumentation of the Brookhaven Natural Thermal Storage House [DE83-000267] p 198 N83-22815

GHAFFARIAN, B.

Flame acceleration mechanisms under conditions of partial confinement [PB83-109884] p 120 N83-19881

GHOSH, A. K.

Practical limiting efficiencies for crystalline silicon solar cells p 37 A83-19893

- GHOSH, H. S.**
Gasification of land-based biomass
[PB83-109918] p 122 N83-19946
- GIACHIELLO, A.**
Fiat researchers study ceramics applications in diesels
p 199 N83-17760
- GIALANELLA, L.**
Passive-Solar Commercial Buildings Program, 1980 - 1982
[DE82-012472] p 72 N83-21202
- GIBON, G.**
EA study of solar concentrator panels with fluorescent compounds
p 40 A83-22911
- GILL, S. P.**
High power pulsed plasma MHD experiments
[AD-A120526] p 176 N83-20781
High power pulsed plasma MHD experiments
[AD-A120526] p 176 N83-20782
- GILLIAM, T. M.**
Metal recovery from eastern oil shale
[DE82-004052] p 109 N83-18016
- GINEVAN, M. E.**
Biostatistics and health impacts of energy technologies
p 36 N83-22962
- GINN, R. H.**
Programmatic environmental overview Biomass fuels program
[DE82-906065] p 101 N83-16975
- GINSBERG, I. W.**
Advanced thermal-sensor-system development via shuttle sortie missions
[DE82-004932] p 98 N83-16834
- GINSBURG, B. R.**
Twin disk composite flywheel
p 189 A83-27304
- GIORDANO, P. M.**
Programmatic environmental overview Biomass fuels program
[DE82-906065] p 101 N83-16975
- GIRENS, S. P.**
Long titanium heat pipes for high-temperature space radiators
p 185 A83-27127
- GIULIANI, A. J.**
Landfill gas to electricity demonstration project
[PB82-255290] p 7 N83-16943
- GIULIANO, M. N.**
Advanced cell designs for welded arrays
p 50 A83-27257
- GIVEN, P. H.**
The relevance of coal geochemistry to coal utilization
p 144 N83-22767
- GLADSTONE, D. H.**
Convective heat losses from flat-plate solar collectors in turbulent winds
p 43 A83-23883
- GLASGOW, J. C.**
The response of a 38m horizontal axis teetered rotor to yaw
p 169 N83-19232
Stall induced instability of a teetered rotor
p 169 N83-19234
- GLUSKOTER, H. J.**
Coal geology Who needs it? p 112 N83-18140
- GODEV, N.**
Current aspects of wind-energy utilization - Status and prospects in Bulgaria
p 91 A83-22421
- GOEBEL, K.**
Power plant concepts using new coal conversion technologies
[BMFT-FB-T-82-031] p 131 N83-21506
- GOELTZ, R.**
Analysis of energy use at US institutional buildings
[DE82-004670] p 6 N83-16886
- GOELZ, W.**
Technology of elevated voltage solar arrays Key items test and evaluation Part 2 Simulated LEO-plasma tests
[ESA-CR(P)-1646] p 73 N83-21513
- GOETZ, G. J.**
Effect of liquefaction processing conditions on combustion characteristics of solvent-refined coal
[DE82-903665] p 139 N83-22361
- GOFF, F.**
Geothermal data for 95 thermal and nonthermal waters of the Valles Caldera, southern Jemez Mountains region, New Mexico
[DE82-017397] p 130 N83-21496
- GOIN, K. L.**
Experience in testing of a solution mined storage cavern
[DE82-011013] p 113 N83-18464
- GOLDEN, J. A.**
Coal desulfurization by a microwave process
[DE82-007514] p 118 N83-19854
- GOLDENBLATT, M.**
Economics of wind energy for utilities
p 116 N83-19270
- GOLDMAN, Y.**
Flames with impinging jets
p 91 A83-21423
- The use of slurry fuels in industrial furnaces
[TAE-428] p 106 N83-17729
- GOLDSBERRY, F. L.**
The variable pressure supercritical Rankine cycle for integrated natural gas and power production from the geopressed geothermal resource
[DE82-008957] p 179 N83-21591
- GOLDSTEIN, S. L.**
Manufacture, distribution, and handling of nitrate salts for solar-thermal applications
[DE83-003317] p 79 N83-21625
- GOLDSTONE, L. A.**
Irrigation pumping using geothermal energy
[DE83-005308] p 135 N83-21641
- GOLSHANI, A.**
Hydraulic air compressor for ocean thermal energy conversion applications
[DE82-005198] p 163 N83-16880
- GONZALEZ-SANABRIA, O. D.**
Cross-linked polyvinyl alcohol films as alkaline battery separators
p 149 A83-20576
- GONZALEZ, C. C.**
Photovoltaic array Power conditioner interface characteristics
[NASA-CR-169919] p 64 N83-19225
- GONZALEZ, E. R.**
The structure of the double layer at the mercury-phosphoric acid interface from studies of adsorption of thiourea and its implications on oxygen reduction kinetics
p 149 A83-19876
- GOODALE, D.**
Thermionic converters for terrestrial applications
p 159 A83-27299
Solar thermionic energy converter experiment
p 51 A83-27301
- GOODGER, E. M.**
Radiation and smoke from the gas turbine combustor using heavy fuels
p 92 A83-23877
- GORDON, J. S.**
The implications of a stochastic approach to air-quality regulations
[DE83-001636] p 9 N83-16972
- GORDON, L. H.**
Mod-2 wind turbine project assessment and cluster test plans
p 172 N83-19262
- GORNOSTAEV, L. S.**
Possibilities of improving degree of perfection and effectiveness of use of secondary thermal energy resources
[BLL-M-26859-(5825 4)] p 143 N83-22738
- GOSPODINOV, M.**
Photoelectrochemical processes in bismuth germanium oxide, Bi₂GeO₂₀ single crystals
p 38 A83-20581
- GOSWAMI, D. Y.**
Renewable energy system feasibility study
[AD-A121252] p 15 N83-18035
- GOYAL, A.**
Coal gasification for stationary gas-turbine applications
[DE82-902135] p 97 N83-16553
- GOYERT, J.**
Development of statistical databases for toxicological studies
[DE82-005196] p 10 N83-17067
- GOYERT, J. C.**
Environmetrics of synfuels Part 4 Project Results Tracking System (PRTS)
[DE82-011444] p 10 N83-16977
Statistical database management for ecosystem-effects analysis
[DE82-005199] p 18 N83-18104
Cartographic evaluation of environmental-management strategies
[DE82-009828] p 35 N83-22702
- GRADY, S.**
Evaluation of utility home-energy-audit programs A Wisconsin example
[DE82-008134] p 6 N83-16924
- GRAVES, J.**
Development of management technology for large power systems
p 46 A83-27147
- GRAVES, R. L.**
Engineering systems analysis of pressurized fluidized-combustion power systems
[DE82-013390] p 127 N83-21083
- GREEN, M. A.**
Accuracy of analytical expressions for solar cell fill factors
p 41 A83-22914
- GREENAWAY, R.**
Automated installation methods for photovoltaic arrays
[DE83-004272] p 82 N83-22796
- GREENBAUM, E.**
Experimental techniques for the study of photosynthetic water splitting
[DE82-003974] p 89 N83-17668
- GREGORY, P. E.**
Single and multijunction space solar cells grown by organometallic vapor phase epitaxy /OM-VPE/
p 50 A83-27260
Accelerated aging of GaAs concentrator solar cells
[DE82-016658] p 69 N83-20390
Design and demonstration of a spectrum-splitting photovoltaic concentrator module
[DE83-003669] p 79 N83-21634
- GREINER, N. R.**
Proceedings of the Workshop on Radioactivity Associated with Coal Gas
[DE82-007860] p 18 N83-18100
- GRENON, M.**
A review of world hydrocarbon resource assessments
[DE83-900732] p 131 N83-21499
- GRENS, E. A., II**
Anti-misting additives for jet fuels
[NASA-CR-169751] p 94 N83-16417
Viscometric and misting properties of polymer-modified fuel
[NASA-CR-169750] p 96 N83-16543
- GRIFFIN, F. P.**
Engineering systems analysis of pressurized fluidized-combustion power systems
[DE82-013390] p 127 N83-21083
- GRIFFIN, R. C.**
Economic and engineering evaluation of plant oils as a diesel fuel
[DE83-900805] p 141 N83-22464
- GRIGGS, H. M.**
The comprehensive community energy management program An evaluation
[DE82-011552] p 17 N83-18060
- GRIGSBY, C. O.**
Geothermal data for 95 thermal and nonthermal waters of the Valles Caldera, southern Jemez Mountains region, New Mexico
[DE82-017397] p 130 N83-21496
- GRODZKA, P. G.**
Performance and operational analysis of a liquid desiccant open-flow solar collector
p 49 A83-27246
- GROET, S. S.**
The utilization of emergent aquatic plants for biomass-energy-systems development
[DE82-009174] p 124 N83-20395
- GROMER, J. M.**
A geologic study of the Raton Basin
[PB83-136275] p 147 N83-22903
- GRONCKI, P. J.**
Modeling energy/economy interactions for conservation and renewable energy-policy analysis
[DE82-009159] p 7 N83-16926
- GROSSHANDLER, W. L.**
Characteristics of coal/light hydrocarbon slurries in spray combustion
[DE82-006294] p 102 N83-17639
- GROSSMAN, G.**
Conceptual design and performance analysis of absorption heat pumps for waste-heat utilization
[DE82-010202] p 186 N83-20060
Adiabatic absorption and desorption for improvement of temperature-boosting adsorption heat pumps
[DE83-002589] p 33 N83-21611
- GROVES, W. N.**
Energy from humid air
[DE82-017121] p 180 N83-21601
- GROW, J.**
Leachate-treatment technique utilizing fly ash as low-cost sorbent
[DE82-010501] p 111 N83-18101
- GRUBBER, C. L.**
Energy from humid air
[DE82-017121] p 180 N83-21601
- GRUHL, J.**
Estimating pollutant exposures from coal fired power plants in a rural region
[DE82-008136] p 19 N83-18109
- GRUNES, H.**
Development of an advanced solar augmented water heater (for single family home applications)
[PB83-119610] p 84 N83-22842
- GUERRA, S.**
Fiat researchers study ceramics applications in diesels
p 199 N83-17760
- GUESDON, J. P.**
Photoconductivity and photovoltaic effect in indium selenide
p 39 A83-22337
- GUR, T. M.**
Methane synthesis on nickel by a solid-state ionic method
p 91 A83-22324
- GURLEY, L. R.**
Potential biological hazards of nickel arsenides associated with retorting of oil shale Toxic effects of particulate Ni₅As₂
[DE82-010978] p 22 N83-19328

GUSTAFERRO, J. F.

US energy for the rest of the century
[PB83-114603] p 36 N83-22838

GWINNER, D

Possibilities of improving exhaust emissions and energy consumption in mixed hydrogen-gasoline operation
p 87 A83-27334

H

HABEGGER, L. J.

A technology assessment of solar energy systems
Direct combustion of wood and other biomass in industrial boilers
[DE83-000937] p 31 N83-21538

HACKETT, C. E.

Evaluation and application of solid thermal energy carriers in a high temperature solar central receiver system
p 47 A83-27235

HADLEY, D. L.

Candidate wind-turbine-generator site summarized meteorological data for the period December 1976 through December 1981
[DE83-000884] p 102 N83-17028
Meteorological field measurements at potential and actual wind-turbine sites
[DE83-001493] p 174 N83-19398

HAEUSER, J.

Simulation of air-pollution propagation resulting from at-sea incineration wastes
[DE82-902297] p 10 N83-16979

HAGAN, D. A.

Supernsulated homes in North America A review and update
[DE82-011565] p 21 N83-19290

HAGAN, R. C.

Relationship between pyrite formation and organic sulfur content of coal as revealed by electron microscopy
[DE82-010417] p 104 N83-17652

HAGEDORN, N. H.

Design flexibility of redox flow systems
p 189 A83-27177

HAGELY, J. R.

Design and market study of photovoltaic systems for commercial building and applications Volume 3
Appendices
[DE82-016729] p 70 N83-20397

HAGEN, D. L.

Design of plywood and paper flywheel rotors
[DE83-002276] p 195 N83-20430

HAGEN, K. G.

The development of solar-assisted gas-fired appliances, phase 2
[PB82-231663] p 66 N83-19312

HAGENSON, R. L.

Utilization of the catalyzed-DD fuel cycle in Reversed-Field Pinch Reactors (RFPs)
[DE82-010425] p 168 N83-18512

HAGGERTY, J. S.

Graded-index antireflective coatings for glass
[DE82-016756] p 67 N83-19917
Chalcogenide-glass solar cells
[DE82-021243] p 68 N83-20382

HAHM

Force initiations in helicopter rotor blades, wind channel fans and wind turbines
[MB8-UD-356-82-O] p 166 N83-17522

HAHM, W.

Pre-feasibility study for construction of a commercial coal hydrogenation plant
[BMFT-FB-T-82-190] p 109 N83-18034

HALDER, N. C.

Grain boundary effects in polycrystalline silicon solar cells I - Solution of the three-dimensional diffusion equation by the Green's function method II - Numerical calculation of the limiting parameters and maximum efficiency
p 52 A83-27981

HALE, P. L.

A method to estimate weight and dimensions of small aircraft propulsion gas turbine engines User's guide
[NASA-CR-168049] p 162 N83-16343

HALL, K. R.

Thermodynamic properties for natural gas binaries
[PB82-254616] p 98 N83-16565

HALL, R. E.

State-of-the-art combustion modification NOx control for stationary combustion equipment
[PB82-240201] p 23 N83-19340

HALLECT, M. S.

Potential biological hazards of nickel arsenides associated with retorting of oil shale Toxic effects of particulate Ni5As2
[DE82-010978] p 22 N83-19328

HAM, D.

Hot-gas cleanup for molten-carbonate fuel cells
[DE82-002500] p 163 N83-16864

HAM, N. D.

ASI/Finson 1-kilowatt high-reliability wind system development Phase 1 Design and analysis
[DE82-016128] p 180 N83-21602

HAMAMOTO, A.

Study on composite flywheels for energy storage
p 188 A83-22701

HAMEL, W. R.

Dynamic modeling and control analysis of froth flotation and clean-coal filtration as applied to coal beneficiation
[DE82-004555] p 97 N83-16558

HAMILTON, W. F.

Synthetic fuels for transportation Background paper
1 The future potential of electric and hybrid vehicles
[PB83-126086] p 37 N83-23250

HAMM, J. R.

Evaluation of gasification and gas cleanup processes for use in molten carbonate fuel cell power plants
[DE83-003821] p 183 N83-22787

HANE, G. J.

New priorities in energy-conservation research and development
[DE82-005988] p 16 N83-18054

HANEMAN, D.

Effect of an SiC layer on p-n amorphous silicon solar cells
p 40 A83-22909
Factors affecting the efficiency of chemically deposited CdSe based photoelectrochemical cells
p 54 A83-29514

HANEY, D. G.

Aircraft towing feasibility study
p 11 N83-17458

HANKS, D.

Uranium hydrogeochemical and stream sediment reconnaissance of the St Michael NTMS quadrangle, Alaska
[DE82-009999] p 99 N83-16844
Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197

HANNA, A. F.

The effects of atmospheric variability on energy utilization and conservation
[DE83-003612] p 31 N83-21525

HANNA, H.

Development and implementation of dynamic methodologies for evaluating energy conservation strategies
[PB82-240763] p 21 N83-19304
Development and implementation of dynamic methodologies for evaluating energy conservation strategies Executive summary
[PB82-240771] p 21 N83-19305

HANSEL, J. N.

Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska
[DE82-009666] p 115 N83-19196

HARAMURA, S.

50 kW Stirling engine
p 157 A83-27282

HARDESTY, D. R.

Development and application of advanced diagnostics methods in fossil fuel combustion studies
p 90 A83-20436

HARDING, G. L.

Effect of argon pressure on the optical properties of sputtered solar selective surfaces
p 40 A83-22620

HARDING, R. C.

A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas
[DE83-004095] p 135 N83-21686

HARDY, L. C.

Uranium hydrogeochemical and stream sediment reconnaissance of the St Michael NTMS quadrangle, Alaska
[DE82-009999] p 99 N83-16844
Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197

HARDY, L. G.

Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska
[DE82-009666] p 115 N83-19196

HARDY, R. W.

Influence of grain boundaries on solar cell performance
[DE82-004662] p 56 N83-16881

HARPER, J.

Wind system value analysis for electric utilities A comparison of four methods
[DE82-006963] p 164 N83-16883

Electric-utility value determination for wind energy
Volume 2 A user's guide
[DE82-010926] p 134 N83-21596

HARPER, J. R.

Solar electric technologies Methods of electric utility value analysis
[DE82-014285] p 71 N83-20409

HARRIES, W. L.

Theoretical studies of solar-pumped lasers
[NASA-CR-169890] p 60 N83-17871

HARRIS, J.

Automation of the longwall mining system
[NASA-CR-169933] p 114 N83-19183

HARRIS, J. N.

Solar-energy treatment of ceramic tiles
[DE83-000147] p 65 N83-19296

HARRIS, N. C.

Introductory lecture Statement of the problem
p 200 N83-19317

HARRISON, J. W.

Photovoltaic cell and module status assessment
Volume 2 Technology basis
[DE83-900575] p 79 N83-21627
Photovoltaic cell and module status assessment
Volume 1 Technology overview
[DE83-900567] p 82 N83-22791

HARRISON, T. D.

Results of the PRDA 35 qualification tests of the BDM concentrating photovoltaic module
[DE83-002136] p 78 N83-21613
Program for predicting thermal performance based on test data of low- to medium-temperature line-focusing, concentrating solar collectors
[DE82-012605] p 82 N83-22776

HARRISON, W. E.

Geothermal resource assessment in Oklahoma
[DE82-021288] p 100 N83-16874

HARSHA, P. T.

Review of alternative fuels data bases
[NASA-CR-170203] p 140 N83-22439

HART, G. W.

On insolation measurements using pyranometers and solar cell devices
p 48 A83-27238

HARTMAN, T. L.

Development of residential-conservation-survey methodology for the US Air Force Task 2
[DE82-009473] p 18 N83-18077

HARTWIG, S.

Identification of problem areas related to the dispersion of heavy gases
p 200 N83-19318

HARUKI, H.

Amorphous silicon photovoltaic modules
p 45 A83-26064

HARVEY, A. C.

Design of hydraulic output Stirling engine
[NASA-CR-167976] p 181 N83-22739

HARVEY, W. W.

Study to establish cost predictions for the production of Redox chemicals
[NASA-CR-167882] p 194 N83-20359

HASBROUCK, T. M.

Development of the WTS-4 wind turbine design
p 159 A83-27323

HAUGEN, D. A.

Toxicology of coal gasification Chemical characterization
p 148 N83-22960

HAVES, P.

Solar-regenerated desiccant dehumidification
[DE83-900823] p 83 N83-22809

HAYASHI, H.

Sunshine project solar photovoltaic program and recent activities in Japan
p 37 A83-20137

HAYASHI, Y.

Origin of the difference in the open circuit voltage between p-n type and n-p type hydrogenated amorphous silicon solar cells
p 37 A83-19991

HAYDEN, J. H.

Solar array power management
Integration of large electrical space power systems
p 46 A83-27148
p 46 A83-27153

HAYES, D. J.

Isolation of metallic complexes in shale oil and shale oil retort waters
[DE82-005931] p 98 N83-16835

HAYHURST, A. N.

The origin and nature of 'prompt' nitric oxide in flames
p 1 A83-22344

HAZAN, P.

LPG, hydrogen Automobile fuels of tomorrow discussed
p 89 N83-17758

HAZELTON, R. F.

Real time sensors in geothermal fluids, their costs and benefits
[DE82-014857] p 130 N83-21328

- HEALEY, J. J.**
Catalyzed steam gasification of biomass Phase 3 Biomass Process Development Unit (PDU) construction and initial operation
[DE82-010264] p 124 N83-20415
- HEATHERLY, D. E.**
Physical chemistry of molten-salt batteries Current-induced composition gradients in molten LiCl-KCl
[DE83-001684] p 192 N83-16875
- HEATON, H. L.**
Further development and evaluation of coal-water mixture technology
[DE82-010518] p 106 N83-17736
- HEDDEN, K.**
Extraction of coal with solvents in liquid and supercritical state under nonhydrogenating and hydrogenating conditions
[BMFT-FB-T-82-177] p 109 N83-18032
- HEDDEN, R. E.**
Thermal performance case studies for residential solar heating and cooling systems
[PB82-260100] p 59 N83-16940
- HEESS, F.**
Investigation of latent heat storage materials in the medium and high temperature range
[PB82-259896] p 193 N83-16933
- HEFFNER, G. C.**
Federal applications for wind energy systems A subcontract report
[DE83-000306] p 31 N83-21543
- HEFLICK, S. K.**
Vertical extrapolations of wind speed
[DE83-000944] p 136 N83-21723
- HEGER, N.**
Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels
[PB82-255167] p 96 N83-16459
- HEHEMANN, R. F.**
Localized corrosion in materials for geothermal power
[DE82-015608] p 128 N83-21136
- HEID, W. G., JR.**
Progress of solar technology and potential farm uses
[PB83-100065] p 71 N83-20436
- HEIKAL, H.**
Large parabolic dish collectors with small gas-turbine, Stirling engine or photovoltaic power conversion systems
p 160 A83-27329
- HEIMANN, M.**
Uncertainties of predictions of future atmospheric CO₂ concentrations
p 2 A83-24251
- HEINE, D.**
Investigation of latent heat storage materials in the medium and high temperature range
[PB82-259896] p 193 N83-16933
- HELLER, M.**
Systems analysis of on-site integrated energy systems, phase 1
[DE83-000044] p 179 N83-21549
- HENDRICKSON, P. L.**
Overview of existing residential energy-efficiency rating systems and measuring tools
[DE83-003148] p 20 N83-19289
- HENDRIE, S. D.**
Photovoltaic/thermal collector development program
[DE82-012572] p 71 N83-20416
- HENDRY, R.**
Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703
- HENLINE, W. D.**
Dynamic simulation of sulfur-removal systems
[DE82-902074] p 119 N83-19865
- HENRY, P. J.**
Devonian shale extraction test wells
[DOE/MC-08386/T1] p 108 N83-18013
- HERMELEE, A.**
Systems analysis of hydrogen supplementation in natural gas pipelines
[DE82-006933] p 89 N83-17740
- HERMES, R. E.**
Catalytic coal conversion support Use of laser flash-pyrolysis for structural analysis
[DE82-014124] p 139 N83-22366
- HERMINA, W. L.**
Hall-Field limitations in MDH generators
[DE83-001149] p 177 N83-21246
- HERTZBERG, A.**
Radiative energy receiver for high performance energy conversion cycles
p 46 A83-27138
- HERZ, J.**
Initial detailed designs for intermediate photovoltaic systems Branch bank
[DE82-005854] p 65 N83-19287
- Initial detailed designs for intermediate photovoltaic systems Warehouse
[DE82-014534] p 69 N83-20396
- HEWITT, R.**
Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment
[NASA-CR-169801] p 191 N83-16858
- HEYWANG, W.**
Amorphous silicon - A new semiconductor material for solar cells
p 39 A83-21627
- HIBBARD, W. R., JR.**
Acid precipitation A critique of present knowledge and proposed action
[DE83-900303] p 34 N83-21650
- HIBBS, B. D.**
Definition of cost-effective river-turbine designs
[DE82-010972] p 175 N83-20413
- HIESTER, T. R.**
Wind turbine siting A summary of the state of the art
p 116 N83-19240
- HIGH, J.**
Automation of the longwall mining system
[NASA-CR-169933] p 114 N83-19183
- HILDEBRAND, S. G.**
Analysis of environmental issues related to small-scale hydroelectric development 6 Dissolved oxygen concentrations below operating dams
[DE82-007127] p 22 N83-19329
- HILER, E. A.**
Economic and engineering evaluation of plant oils as a diesel fuel
[DE83-900805] p 141 N83-22464
- Ethanol production in small- to medium-size facilities
[DE83-900875] p 146 N83-22807
- HILFIKER, K.**
Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703
- HILL, G. M.**
Photovoltaic array Power conditioner interface characteristics
[NASA-CR-169919] p 64 N83-19225
- HILL, S. C.**
Combustion research needs
[PB83-107813] p 128 N83-21091
- HILLIS, D.**
OTEC plants for today's island market
p 156 A83-27227
- HIMY, A.**
Large nickel alkaline batteries
p 189 A83-27176
- HINRICHS, T. L.**
Emulsified fuel testing in a medium speed diesel engine
[PB82-250697] p 98 N83-16564
- HIRAMOTO, M.**
Photoelectrolysis of water under visible light with doped SrTiO₃ electrodes
p 38 A83-20580
- HIRATA, M.**
A study on two-phase, two-component Stirling engine
p 160 A83-27328
- HIRN, O.**
Swedish national and local government programs for conservation of energy in buildings
[PB82-246752] p 22 N83-19307
- HIRST, E.**
Energy audits at 48 hospitals
[DE82-002814] p 5 N83-16884
- Analysis of energy use at US institutional buildings
[DE82-004670] p 6 N83-16886
- Evaluation of utility home-energy-audit programs A Wisconsin example
[DE82-008134] p 6 N83-16924
- HOCH, C. J.**
An overview of the DOT/FAA aviation energy conservation policy
p 11 N83-17460
- HODGE, D.**
Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703
- HODGE, P. E.**
Critical research and advanced technology (CRT) support project
[NASA-TM-63019] p 123 N83-20361
- HOFER, K. E.**
Fatigue testing of low-cost fiberglass composite wind turbine blade materials
[NASA-CR-165566] p 181 N83-22746
- HOFFMANN, J. P.**
Study based on ammonia/water solutions of a distinct heating transport system
[BMFT-FB-T-82-188] p 186 N83-18033
- HOGEN-ESCH, T. E.**
Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery
[DE82-008705] p 140 N83-22436
- HOGH, T. C.**
Transportation network models for energy supply analysis Volume 3 Transportation network model user's guide and documentation
[DE82-903079] p 187 N83-20400
- HOHENEMSER, K. H.**
The investigation of passive blade cyclic pitch variation using an automatic yaw control system
[DE83-000651] p 178 N83-21548
- HOISINGTON, J. E.**
Radioisotopes for heat-source applications
[DE83-005045] p 137 N83-21934
- HOLLADAY, G.**
The HFEM monitoring of coal gasification Rawlins, Wyoming
[DE82-013801] p 142 N83-22466
- HOLLANDS, K. G. T.**
A probability density function for the clearness index, with applications
p 53 A83-28938
- Heat loss coefficients and effective tau-alpha products for flat-plate collectors with diathermanous covers
p 53 A83-28939
- HOLLECK, G. L.**
Development of a high capacity toroidal Ni/Cd cell
[NASA-CR-169945] p 174 N83-19273
- HOLLEY, E. P.**
Liquid-phase methanol process development unit Installation, operation, and support studies
[DE82-012725] p 121 N83-19940
- HOLLEY, W. E.**
Atmospheric turbulence parameters for modeling wind turbine dynamics
p 171 N83-19252
- HOLLOWELL, C. D.**
Radon-daughter exposures in energy-efficient buildings
[DE82-003711] p 9 N83-16964
- HOLMES, J. T.**
The 5 MW for solar-chemistry development
[DE82-002064] p 60 N83-18043
- Central receiver test facility assembly building
[DE82-010853] p 76 N83-21567
- HOLSTE, J. C.**
Thermodynamic properties for natural gas binanes
[PB82-254616] p 98 N83-16565
- HOMMA, T.**
National project of new energy development in Japan
p 48 A83-27243
- HONERKAMP, R. L.**
Evaluation of the maintenance effect on fugitive emissions from refineries in the south coast air quality management district
[PB82-239260] p 23 N83-19356
- HONNEYWELL, R.**
Spacecraft power technology
p 153 A83-27157
- HOOGENDOORN, C. J.**
Numerical calculation of the heat transfer by natural convection in a cubical enclosure
p 42 A83-23212
- HOOK, W. R.**
Systems and operations - Living with complexity and growth
p 86 A83-24357
- HOOVERMAN, R. H.**
Catalyzed steam gasification of biomass Phase 3 Biomass Process Development Unit (PDU) construction and initial operation
[DE82-010264] p 124 N83-20415
- HOPP, W. J.**
New priorities in energy-conservation research and development
[DE82-005988] p 16 N83-18054
- HORN, F. L.**
Nuclear reactors using fine particulate fuel for primary power in space
p 155 A83-27221
- HORNE, W. E.**
Improved thermophotovoltaic power system
p 46 A83-27139
- HORST, D.**
Sideslip indication system
p 12 N83-17466
- HORTON, R. M.**
Effect of simulated medium-Btu coal gasifier atmospheres on the biaxial stress rupture behavior of four candidate coal gasifier alloys
[DE82-008607] p 104 N83-17661
- HOUSEMAN, J.**
Combustion engine system
[NASA-CASE-NPO-14565-2] p 89 N83-19826
- HOUSTON, L.**
A clean internal combustion engine for underground mining machinery A technical assessment and program plan, phase 1
[PB82-244724] p 89 N83-19104
- HOWARD, B. D.**
Contemporary Systems, Inc., Walpole, New Hampshire solar-energy-system performance evaluation
[DE83-000068] p 57 N83-16894

- Gill Harrop, Big Flats, New York solar-energy-system performance evaluation [DE83-00065] p 57 N83-16895
- HOWARD, J. B.**
Coal pyrolysis by hot solids from a fluidized-bed combustor [DE83-003344] p 117 N83-19829
- HOWELL, M.**
Results of u-bend stress-corrosion-cracking specimen exposures in coal-liquefaction pilot plants [DE82-012889] p 105 N83-17708
Coal-liquefaction-plant fractionation-column corrosion-coupon studies [DE82-007469] p 139 N83-22360
- HSUEH, K.-L.**
The structure of the double layer at the mercury-phosphoric acid interface from studies of adsorption of thiourea and its implications on oxygen reduction kinetics p 149 A83-19876
- HUBER, H. D.**
AQUASTOR - A computer model for cost analysis of aquifer thermal energy storage coupled with district heating or cooling systems p 191 A83-27314
User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 1 Main text [DE82-022512] p 99 N83-16865
User manual for GEOCITY A computer model for cost analysis of geothermal district-heating-and-cooling systems Volume 2 Appendices [DE82-022511] p 99 N83-16866
Cost of heat from a seasonal source [DE82-006026] p 194 N83-18045
Evaluation of ammonia as a working fluid for a wet/dry-cooled binary geothermal plant [DE83-002895] p 135 N83-21631
- HUDSON, R. F.**
The Second Conference on the Environmental Chemistry of Hydrazine Fuels [AD-A121324] p 13 N83-17731
- HUDSON, W. R.**
The NASA program in Space Energy Conversion Research and Technology p 160 A83-27326
- HUFF, J. R.**
Acid fuel cell technologies for vehicular power plants p 154 A83-27185
Feasibility evaluation of fuel cells for selected heavy-duty transportation systems [DE83-002953] p 179 N83-21550
- HUFFMAN, F.**
Thermionic technology infrastructure for space power p 159 A83-27298
Thermionic converters for terrestrial applications p 159 A83-27299
- HUGET, R. G.**
A probability density function for the clearness index, with applications p 53 A83-28938
- HUGGINS, R. A.**
Methane synthesis on nickel by a solid-state ionic method p 91 A83-22324
- HUGHES, D. A.**
Thermal fatigue tests of Solar One receiver-tube weldments [DE82-012520] p 81 N83-22599
- HUGHES, P. S.**
The MOD-OA 200 kilowatt wind turbine generator design and analysis report [NASA-CR-165127] p 163 N83-16859
Multiple and variable speed electrical generator systems for large wind turbines p 170 N83-19236
- HUGHES, T. G.**
Stored chemical energy propulsion system for underwater applications [AIAA PAPER 81-1601] p 188 A83-23132
- HUIBERS, D. T. A.**
Catalytic evaluation for H-coal [DE82-014457] p 138 N83-22355
- HUISINGH, J. L.**
Short-Term Bioassays in the Analysis of Complex Environmental Mixtures 2 [PB82-233172] p 23 N83-19420
- HULES, K. R.**
Sperry low-temperature geothermal conversion system Volume 1 Organic-working-fluid properties [DE82-018529] p 163 N83-16867
- HULSTROM, R. L.**
Additional solar spectral data sets p 199 A83-25450
Terrestrial solar spectral data sets [DE83-000504] p 60 N83-17001
- HUM, G. P.**
Exploratory study of coal conversion chemistry [DE82-013414] p 138 N83-22354
- HUNN, B. D.**
The application of DOE-2 in the predesign phase of commercial-building design [DE82-014067] p 31 N83-21201
- HUNSAKER, D. B., JR.**
The implications of a stochastic approach to air-quality regulations [DE83-001636] p 9 N83-16972
- HUNT, J. M.**
Problems in organic geochemistry applied to petroleum exploration and production p 144 N83-22765
- HUNT, T. K.**
Solar residential total energy system using the sodium heat engine - A concept study p 47 A83-27231
- HUNTER, L.**
Environmental quality research Fate of toxic jet fuel components in aquatic systems [AD-A122548] p 30 N83-21168
- HUNTLEY, W. R.**
Steam ejector as an industrial heat pump [DE82-010194] p 14 N83-17847
- HURAIB, F. S.**
Operational results from the Saudi solar village photovoltaic power system p 48 A83-27240
- HUSBAND, S. N.**
Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States [DE82-011237] p 18 N83-18108
- HUSKEY, B.**
Advanced solar/gas desiccant cooling system [PB82-248333] p 62 N83-18968
- HUTCHISON, B. A.**
Use of vegetation to ameliorate building microclimates An assessment of energy-conservation potentials [DE82-013255] p 32 N83-21572
- HUTTON, G.**
Wave model A numerical model for the frictional absorption of water waves [PB83-100792] p 122 N83-20073
- HWANG, W. K.**
Survey of nuclear fusion technology A prospect analysis of Tokamak fusion research [DE82-700131] p 168 N83-18451
- HYNEK, S.**
Design and component testing of a low-temperature waste-heat-driven refrigeration system, phases 1 and 2 [DE82-014721] p 179 N83-21571
- IAROSHEVICH, S. V.**
The effect of the melt heat treatment time on the properties of lithium lubricants with additives p 84 A83-26921
- IGNATIEV, A.**
Long term solar irradiation heating of black chrome [DE83-000032] p 58 N83-16909
- ILES, P. A.**
Current developments in silicon space cells p 50 A83-27256
- IMHAUSEN, K. H.**
Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels [PB82-255167] p 96 N83-16459
- INABA, L. K.**
Collection, transportation, and storage of biomass residues in the Pacific Northwest [DE82-004737] p 100 N83-16887
- INAL, O. T.**
Thermal degradation of solar collector surfaces p 44 A83-25535
- INGERSOLL, J. G.**
Radon-daughter exposures in energy-efficient buildings [DE82-003711] p 9 N83-16964
- INGS, J. B.**
An evaluation of hydrated calcium aluminate compounds as energy storage media [PB82-249921] p 194 N83-19308
- INUTAKE, T.**
Study on composite flywheels for energy storage p 188 A83-22701
- IRONS, J.**
Preliminary evaluation of environmental issues on the use of peat as an energy source [DE83-000820] p 34 N83-21651
- ISAACSON, H. R.**
Methane from landfills: Preliminary assessment workbook [DE83-002319] p 111 N83-18075
- ISHANOV, M. KH.**
Results of the investigation of the oil and gas deposits of Tadzhikistan on the basis of space photographs p 94 A83-26805
- ISHIZAKI, Y.**
50 kW Stirling engine p 157 A83-27282
- ISSHIKI, N.**
R and D of energy saving and new energy utilization in Japanese marine engineering p 4 A83-27225
- IVANOV, V. V.**
An improved portable thermoradiometer /TRM/ for measuring the relative emissivity of solids at room temperature p 39 A83-20959
- IVEY, D. G.**
Storing energy in metal hydrides - A review of the physical metallurgy p 188 A83-21562
- IVSAN, T.**
Rankine/Rankine cycle gas-fired heat pump [PB82-254640] p 165 N83-16944
- IWABUCHI, S.**
Sodium-sulfur battery program in Japan p 189 A83-27175
- IWASAKI, E.**
A study on two-phase, two-component Stirling engine p 160 A83-27328

J

- JABLONSKI, G.**
Evaluation of gasification and gas cleanup processes for use in molten carbonate fuel cell power plants [DE83-003821] p 183 N83-22787
- JACKSON, J. L.**
Photovoltaic retrofit feasibility in the United States [DE82-014508] p 69 N83-20393
- JACKSON, S. V.**
Impact of flywheel-energy-storage technology upon taxicab fleet operation in a large metropolitan city [DE82-002371] p 194 N83-18591
- JACOB, K. T.**
Corrosion of 310 stainless steel in H₂-H₂O-H₂S gas mixtures Studies at constant temperature and fixed oxygen potential p 90 A83-20265
- JACOBSON, D.**
Analytical and experimental investigations of sodium heat pipes and thermal energy storage systems [AD-A122093] p 195 N83-20375
- JACOBSON, D. L.**
Performance of a cylindrical phase-change thermal energy storage unit p 191 A83-28969
- JACOBSON, I. A., JR.**
Reverse-combustion, horizontal retorting of oil shale [DE83-000018] p 137 N83-22350
- JACOBSON, R. A.**
Fossil-energy [DE83-003817] p 124 N83-20383
- JACQUES, M. T.**
Design strategy for the combustion of coal-derived liquid fuels [DE82-905496] p 95 N83-16444
- JAFFE, L. D.**
Optimization of dish solar collectors with and without secondary concentrators [NASA-CR-169928] p 64 N83-19224
- JAFFE, R. I.**
Some 2 1/4Cr-1 Mo steels for coal-conversion pressure vessels [DE82-901349] p 105 N83-17707
- JAIN, G. C.**
Diffusion length determination in n+/p-p+/p+ structure based silicon solar cells from the intensity dependence of the short-circuit current for illumination from the p+/side p 52 A83-27982
- JAIN, K.**
SNG from land-based biomass 1981 program [PB83-10467] p 125 N83-20440
- JAMES, R. K.**
Joule heating effects in MHD generator boundary layers p 161 A83-28956
- JAMISON, S. W.**
Programmatic environmental overview Biomass fuels program [DE82-906065] p 101 N83-16975
- JANETZKE, D. C.**
Performance and load data from Mod-OA and Mod-1 wind turbine generators p 171 N83-19255
- JANSSEN, A. J.**
Operating considerations in reliability of modelling of wind-assisted utility systems p 150 A83-22022
- JASINSKI, R.**
A zinc paste primary battery p 153 A83-26052
- JATAR, S.**
A semiconductor-insulator-semiconductor CdO-SiO₂-Si solar cell p 41 A83-22912
- JAVID, S. H.**
Control design for a wind turbine-generator using output feedback p 152 A83-24721
Control design and performance analysis of a 6 MW wind turbine-generator p 162 A83-29897

- JEFFREYS, D. J.**
Ignition sources of LNG vapor clouds
[PB82-262577] p 96 N83-16461
- JENKINS, D. R.**
Hail impact testing procedure for solar collector covers
[PB83-104745] p 84 N83-22841
- JENSEN, G. A.**
Real time sensors in geothermal fluids, their costs and benefits
[DE82-014857] p 130 N83-21328
- JERGER, D. E.**
Gasification of land-based biomass
[PB83-109918] p 122 N83-19946
- JESCH, R. L.**
Development of High Frequency Electromagnetic Mapping (HFEM) technology
[DE82-012773] p 122 N83-19998
- JETT, O. J.**
Low-temperature pyrolysis of coal to produce diesel-fuel blends
[DE83-001637] p 126 N83-21076
- JOHANSON, E. S.**
Catalytic evaluation for H-coal
[DE82-014457] p 138 N83-22355
- JOHNSON, D. C.**
Improved Stirling engine performance using jet impingement
p 158 A83-27288
- JOHNSON, D. H.**
The energy of the ocean thermal resource and the second-law efficiency of idealized ocean thermal energy conversion power cycles
[DE83-000449] p 167 N83-18071
- JOHNSON, D. R.**
Investigation of attic-insulation effectiveness using actual energy-consumption data
[DE82-006822] p 17 N83-18055
- Project DEEP STEAM**
[DE82-010945] p 111 N83-18078
- Investigation of attic insulation effectiveness using actual energy consumption data**
[DE83-000225] p 36 N83-22828
- JOHNSON, I.**
Alkali-metal-vapor removal from pressurized fluidized-bed combustor flue gas
[DE82-008088] p 10 N83-16976
- JOHNSON, J.**
Design of a photovoltaic system for a southeast all-electric residence
[DE82-009349] p 69 N83-20394
- JOHNSON, J. L.**
The stellarator approach to toroidal plasma confinement
[DE82-005727] p 165 N83-17325
- JOHNSON, J. S., JR.**
New physical-chemical reactions useful for TES
[DE82-020807] p 195 N83-20432
- JOHNSON, L. A.**
Economic and engineering evaluation of plant oils as a diesel fuel
[DE83-900805] p 141 N83-22464
- JONES, G. E., JR.**
Fuel quality-processing study Volume 1 Overview and results
[NASA-CR-165326-VOL-1] p 143 N83-22750
- Fuel quality-processing study Volume 2 Literature survey**
[NASA-CR-165326-VOL-2] p 143 N83-22751
- Fuel quality-processing study Volume 3 Fuel upgrading studies**
[NASA-CR-165326-VOL-3] p 144 N83-22754
- JONES, N. O.**
Colorado geothermal resource assessment Shallow-hole temperature survey Intermediate-depth holes IGH no 1 and no 2, Depth test hole 44X-10
[DE83-002898] p 135 N83-21621
- JONES, R. F.**
Design and construction of a demonstration residence utilizing natural thermal storage
[DE82-005508] p 5 N83-16569
- Thermal performance of the Brookhaven natural thermal storage house**
[DE82-005507] p 56 N83-16879
- JONES, R. G.**
Instrumentation of the Brookhaven Natural Thermal Storage House
[DE83-000267] p 198 N83-22815
- JONES, R. M.**
Comparison of evolving photovoltaic and nuclear power systems for earth orbital applications p 45 A83-27131
- JONES, R. W.**
Annual thermal performance of sunspace-type passive-solar collectors for residence heating Attached and semi-enclosed geometries
[DE83-002310] p 56 N83-16888
- JORDAN, J.**
Instrumental methods of analysis of sulfur compounds in synfuel process streams
[DE82-011559] p 95 N83-16446
- JORDAN, J. E.**
Programmatic environmental overview Biomass fuels program
[DE82-906065] p 101 N83-16975
- JORGENSEN, C. K.**
The uranyl ion, fluorescent and fluorone-like - A review
p 45 A83-26061
- JOSEPH, B.**
Theoretical and experimental studies of fixed-bed coal gasification reactors
[DE82-009515] p 104 N83-17655
- JOUBERT, J. I.**
Combustion of solvent-refined coal in a 100 HP firetube boiler
[DE82-007670] p 103 N83-17640
- JUDKINS, R. R.**
Fossil energy materials program plan for fiscal years 1982 through 1986
[DE83-004237] p 131 N83-21519
- K**
- KACIM, M.**
A study of a solar central power plant with a gas turbine - Project Sirocco modelling and control
p 53 A83-28652
- KAHN, C.**
Dynamic simulation of Exxon's Catalytic Coal-Gasification process
[DE82-021973] p 146 N83-22823
- KAHN, D. R.**
Partial liquefaction of coal by flash hydropyrolysis
[DE83-001145] p 126 N83-21077
- KAINTHLA, R. C.**
Factors affecting the efficiency of chemically deposited CdSe based photoelectrochemical cells
p 54 A83-29514
- KALEJS, J. P.**
Large area silicon sheet by EFG
[NASA-CR-169920] p 63 N83-19219
- KALIN, R. L.**
The assessment of variable valve timing of internal combustion engines for fuel economy improvements and practicability
[PB82-265364] p 5 N83-16766
- KAMATH, G. S.**
Status of GaAs solar cells for space power applications
p 50 A83-27259
- KAMIMOTO, M.**
Sunshine project solar photovoltaic program and recent activities in Japan
p 37 A83-20137
- KAMOUKAKOS, A.**
Stability analysis of flexible wind turbine blades using finite element method
[NASA-CR-168107] p 177 N83-21508
- KANDARPA, V.**
Reinjection and injection of fluids in geothermal operations (state of the art)
[DE83-001857] p 135 N83-21632
- KANG, M. P.**
Porous perovskite electrode as molten carbonate cathode
p 150 A83-20596
- KANNBERG, L. D.**
Underground energy-storage program overview
[DE83-002059] p 198 N83-22806
- KAU, J. Y.**
Strategies for energy conservation in small office buildings
[PB82-245820] p 22 N83-19306
- KAPELNER, S. M.**
The equilibrium constant for the reversible reaction $H_2S + 3H_2O + /LiO 66K0 34/2 CO_3$ yields $4H_2 + CO_2 + /LiO 66K0 34/2 SO_4$ at elevated temperature
p 150 A83-20590
- KAPLAN, S. I.**
Startup experience with a concentrating photovoltaic power system
[DE82-008833] p 62 N83-18069
- Evaluation of Mississippi County Community College and Northwest Mississippi Junior College solar power systems**
[DE83-004239] p 73 N83-21518
- KARBOVSKI, J. S.**
HYFIRE A Tokamak/high-temperature electrolysis system
[DE82-004806] p 88 N83-17323
- HYFIRE A Tokamak/high-temperature electrolysis system**
[DE82-013851] p 90 N83-23173
- KARGER, R.**
Flue gas desulfurization with waste water evaporation Phase 2 Observation of the experiments at Weiher II
[BMFT-FB-T-82-026] p 125 N83-21053
- KARLSSON, B.**
Properties of oxidized copper surfaces for solar applications I
p 54 A83-29512
- Properties of oxidized copper surfaces for solar applications II**
p 54 A83-29513
- KARNITZ, M. A.**
District heating and more-efficient buildings
[DE81-025437] p 26 N83-20379
- KARPUK, M. E.**
Reformed methanol
[DE83-002096] p 129 N83-21176
- KASATKIN, D. F.**
The properties of fuel fractions obtained by the hydrogenation of Kansk-Achinsk coal
p 94 A83-26920
- KASPER, S.**
Clean-up and processing of coal-derived gas for hydrogen applications
p 87 A83-27336
- KASTER, B.**
Heating of domestic water by waste heat recovery from household refrigerating equipment
[BMFT-FB-T-82-156] p 7 N83-16930
- KASYMOV, O. T.**
A physiological and hygienic evaluation of the work regime of operators who are working in current energy production in Kirghizia
p 4 A83-28765
- KASZYNSKI, G. M.**
Alaskan coal Resources and developmental constraints
[DE83-000860] p 130 N83-21494
- KATAYAMA, K.**
Transient characteristics of flat-plate solar collector
p 42 A83-23333
- KATZ, C. N.**
Dissolved methane concentrations in the southeast Bering Sea, 1980 and 1981
[PB83-112433] p 29 N83-20525
- KATZMAN, M. T.**
Solar-photovoltaic power for broadcasting stations An economic analysis
[DE82-022498] p 55 N83-16873
- KAU, C. C.**
Rates and equilibria of devolatilization and trace element evolution in coal pyrolysis
[PB82-260944] p 96 N83-16460
- KAWADA, H.**
A study on the hydrogen-oxygen diffusion flame in high speed flow
p 93 A83-26199
- KAWAMURA, K.**
Study on composite flywheels for energy storage
p 188 A83-22701
- KAY, R. D.**
Ethanol production in small- to medium-size facilities
[DE83-900875] p 146 N83-22807
- KAZMANN, R. G.**
Use of twin wells and water-source heat pumps for energy conservation in Louisiana
[DE83-900349] p 32 N83-21610
- KEAIRNS, D. L.**
Gas characterization from fluidized-bed coal gasification
[DE82-012396] p 138 N83-22357
- KEARNEY, D. W.**
Solar-augmented applications in industry Phase 2 Conceptual designs, volume 1
[PB83-102301] p 72 N83-20441
- KEDDY, E. S.**
Development of high-temperature liquid metal heat pipes for isothermal irradiation assemblies
p 185 A83-27129
- KEENEY, R. L.**
Decision framework for technology choice Volume 1 A case study of one utility's coal-nuclear choice
[DE82-902213] p 113 N83-18554
- KEIPER, R.**
Experimental investigation of shock initiated methane-combustion near a wall
p 93 A83-26200
- KEISER, J. R.**
Results of u-bend stress-corrosion-cracking specimen exposures in coal-liquefaction pilot plants
[DE82-012889] p 105 N83-17708
- Coal-liquefaction-plant fractionation-column corrosion-coupon studies**
[DE82-007469] p 139 N83-22360
- KELLER, P.**
The photoreduction of water - A study of a model system
p 86 A83-22083
- KELLERMANN, W.**
Redox ion flow cell for solar energy storage
p 54 A83-29407

- KELLEY-HANSEN, K.**
Dissolved methane concentrations in the southeast Bering Sea, 1980 and 1981
[PB83-112433] p 29 N83-20525
- KELLEY, H. J.**
An on-board near-optimal climb-dash energy management
[NASA-CR-169755] p 4 N83-16329
- KELLOGG, W. W.**
Feedback mechanisms in the climate system affecting future levels of carbon dioxide p 2 A83-24252
- KELLY, C. D.**
Solar energy systems Standards for screening plastic containment materials
[PB82-242454] p 62 N83-18921
- KELLY, G. E.**
Strategies for energy conservation in small office buildings
[PB82-245820] p 22 N83-19306
- KELLY, M. L.**
Status report on sulfur iodine thermochemical water-splitting cycle
[DE82-007164] p 88 N83-17633
- KENNA, J. P.**
The multiple layer solar collector p 53 A83-28940
- KENNEDY, J. H.**
Reservoir engineering transient pressure well testing, and petrophysical analyses of western gas sands
[DE82-004879] p 99 N83-16839
- KENNEY, D. D.**
Additional testing of the passive heat-pipe-cooled solar photovoltaic receiver
[DE-83-004474] p 78 N83-21615
- KERENS, G.**
A study of possible detrimental effects on internal combustion engines by the combustion of gasohol blends
[CSIR-ME-446] p 129 N83-21166
- KERKLIN, J. F.**
Diffusion flame studies of the chemical and physical mechanisms of soot formation from aromatic and substituted aromatic fuels
[DE82-009310] p 120 N83-19879
- KERR, Y. H.**
Mesoscale mapping of available hourly solar irradiance by use of data collected by 'Meteosat' p 43 A83-24633
- KERTAMUS, N. J.**
Investigation of methanol as a boiler fuel for electric-power generation
[DE82-905495] p 97 N83-16560
- KERWIN, E. M.**
Optimization technique for improved microwave transmission from multi-solar power satellites p 185 A83-27152
- KHALIFA, H. E.**
Solar/gas Rankine/Rankine-cycle heat pump assessment
[PB82-254863] p 55 N83-16710
- KHATTAB, M. M.**
NNE-SSW fault system in part of the Gulf of Suez and its bearing on oil exploration p 92 A83-24551
- KHINKIS, M. J.**
Multi-fuel low-NOx burner development, phase 2
[PB83-126292] p 147 N83-22845
- KHOKHLOV, G. G.**
A method for producing heat pipes for cooling semiconductor photovoltaic cells and the heat pipe characteristics p 52 A83-28366
- KHOSHAIM, B. H.**
Operational results from the Saudi solar village photovoltaic power system p 48 A83-27240
- KIDNAY, A. J.**
Phase equilibrium properties of coal derived liquids
[PB82-007006] p 102 N83-17638
- KIELY, D. H.**
Stored chemical energy propulsion system for underwater applications
[AIAA PAPER 81-1601] p 188 A83-23132
- KIENLE, J.**
Geothermal energy resource assessment of parts of Alaska
[DE83-000140] p 116 N83-19299
- KIESSLING, R.**
Bipolar lead accumulator cell with high energy density
[PB82-258757] p 193 N83-16934
- KILGOUR, D. B.**
Further development of the fluidyne liquid-piston engine p 156 A83-27275
- KIM, B. C.**
Advanced atmospheric fluidized-bed combustion design Ultrahigh velocity
[DE83-004819] p 128 N83-21088
- KIND, R. J.**
Convective heat losses from flat-plate solar collectors in turbulent winds p 43 A83-23883
- KING, C. J.**
Identification and removal of the organic compounds in coal-conversion condensate waters
[DE82-004825] p 8 N83-16955
- KING, R.**
Preliminary evaluation of environmental issues on the use of peat as an energy source
[DE83-000820] p 34 N83-21651
- KINNEY, L. F.**
Exterior insulating shutter final prototype design
[DE83-004520] p 33 N83-21616
- KINOSHITA, K.**
Workshop on the Status of Industrial Organic Electrochemistry, summary
[DE82-901982] p 103 N83-17647
- KIRCHGAESSNER, B.**
ARLIS 1.0 Linear investigation of aeroelastic systems in rotation
[ISD-293] p 166 N83-17905
- KIRCHHOF, D.**
Linear static and dynamic analysis for hinged rotor blades of 60 m span for a two bladed horizontal axis wind energy converter
[ISD-291] p 167 N83-18030
- KIRCHNER, C.**
Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels
[PB82-255167] p 96 N83-16459
- KIRKWOOD, C. W.**
Decision framework for technology choice Volume 1 A case study of one utility's coal-nuclear choice
[DE82-902213] p 113 N83-18554
- KIRPICH, A.**
Integration of large electrical space power systems p 46 A83-27153
- KIRSCHBAUM, H. S.**
Multiple and variable speed electrical generator systems for large wind turbines p 170 N83-19236
- KIRSCHNER, C.**
Energy optimization in DOD facilities
[DE82-008108] p 7 N83-16925
- KISHIYAMA, K. I.**
The HFEM monitoring of coal gasification Rawlins, Wyoming
[DE82-013801] p 142 N83-22466
- KISS, Z.**
Semiconducting polyacetylene materials for energy-conversion applications
[DE82-012320] p 70 N83-20407
- KJELLSON, E.**
Solar district heating with evacuated collectors First year experience of the Knivsta plant
[PB82-262114] p 59 N83-16939
- KJOLLER, J.**
Magnesium for hydrogen storage p 88 A83-27339
- KLAUSSEN, P.**
Geothermal energy Opportunities for California commerce, phase 1 report
[DE82-009121] p 110 N83-18066
- KLEIN, F.**
Contemporary electric vehicle testing and evaluation p 3 A83-27160
- KLEINE, B.**
Production costing of an Advanced/Innovative Wind Energy Concept (AIWEC) Extension of the SAMICS methodology
[DE83-003085] p 182 N83-22783
- KLEINHUECKELKOTTEN, H.**
Pre-feasibility study for construction of a commercial coal hydrogenation plant
[BMFT-FB-T-82-190] p 109 N83-18034
- KLETT, D. E.**
Renewable energy system feasibility study
[AD-A121252] p 15 N83-18035
- KLINGBERG, T.**
Swedish national and local government programs for conservation of energy in buildings
[PB82-246752] p 22 N83-19307
- KLOPPER, A.**
Investigation and development of systems for the storage of thermal energy in the temperature range from -25 deg C to +150 deg C
[PB82-255258] p 193 N83-16949
- KLOSEK, J.**
Liquid-phase methanol process development unit Installation, operation, and support studies
[DE82-012725] p 121 N83-19940
- KLYUVGANT, V. I.**
Utilization of secondary energy resources at Magnitogorsk Metallurgical Combine
[BLL-M-26856-(5828 4)] p 131 N83-21502
- KNAPP, W. D.**
Performance degradation and cleaning of photovoltaic arrays p 48 A83-27236
- KNECHT, W.**
A system of hydrogen-powered vehicles with liquid organic hydrides p 88 A83-27340
- KNIGHT, R. S.**
Potential fuel savings through improved airframe maintenance p 11 N83-17456
- KNOEDLER, R.**
Comparison of Na/S and LiAl/FeS batteries p 188 A83-27169
- KNUDSON, C. L.**
Liquefaction behavior of a Canadian subbituminous coal in comparison with several US lignites and subbituminous coals
[DE82-021976] p 146 N83-22824
- KNUTSON, B.**
Solar receiver cavity insulation evaluation p 39 A83-22275
- KOBAYASHI, Y.**
A concept of heat pipe engine p 154 A83-27208
- KOBETT, W. F.**
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model
[DE83-004004] p 197 N83-22758
- KOENIG, D. R.**
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, Part 1 Turbomachinery design
[DE83-004005] p 197 N83-22759
- KOCHEV, K.**
Photoelectrochemical processes in bismuth germanium oxide, Bi₁₂GeO₂₀ single crystals p 38 A83-20581
- KOENIG, D. R.**
Design options for the SP-100 thermoelectric Nuclear Space Power Plant p 160 A83-27327
- KOENIG, N.**
Heat energy consumption and intermittent heating
[PB82-255159] p 8 N83-16945
- KOGAI, K.**
Study on composite flywheels for energy storage p 188 A83-22701
- KOHLER, J.**
Residential-appliance load characteristics
[DE82-012883] p 13 N83-17824
- KOHUT, J.**
Leachate-treatment technique utilizing fly ash as low-cost sorbent
[DE82-010501] p 111 N83-18101
- KOLCHINA, A. A.**
A method for producing heat pipes for cooling semiconductor photovoltaic cells and the heat pipe characteristics p 52 A83-28366
- KOLLARS, G.**
Review and evaluation of automotive fuel conservation technologies
[PB83-101139] p 30 N83-20844
- KONDOH, T.**
50 kW Stirling engine p 157 A83-27282
- KONG, M. K.**
Route profile analysis to determine suitability of electric postal-delivery vehicles
[DE82-012216] p 29 N83-20842
- KOPKA, S. J.**
Energy Conservation in Historic Structures An information/awareness bulletin
[DE82-005212] p 6 N83-16903
- KORANDA, J. J.**
Geotoxic materials in the surface environment
[DE82-005855] p 23 N83-19333
- KORCHUNOV, B. N.**
A method for producing heat pipes for cooling semiconductor photovoltaic cells and the heat pipe characteristics p 52 A83-28366
- KORNEGAY, F. C.**
The implications of a stochastic approach to air-quality regulations
[DE83-001636] p 9 N83-16972
- KOROSI, F. A.**
Development of standards and a cost model for coal agglomeration and related studies
[DE82-011047] p 105 N83-17678
- KOSANOVICH, N. S.**
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model
[DE83-004004] p 197 N83-22758
- KOSKY, P. G.**
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, Part 1 Turbomachinery design
[DE83-004005] p 197 N83-22759
- KOSKY, P. G.**
Catalytic effects of alkali metal salts in the gasification of coal char
[DE82-000850] p 103 N83-17645

- KOSTKA, H.**
Continuously adjustable low-power gasifier burner/boiler system
[BMFT-FB-T-82-038] p 131 N83-21507
- KOSTYGOV, A. S.**
A method for producing heat pipes for cooling semiconductor photovoltaic cells and the heat pipe characteristics p 52 A83-28366
- KOTNALA, R. K.**
Diffusion length determination in $n/+/-p-p/+/-$ structure based silicon solar cells from the intensity dependence of the short-circuit current for illumination from the $p/+/-$ side p 52 A83-27982
- KOVALSKY, L. J.**
Application of microprocessor-based controls in an ac/dc power conversion system p 188 A83-27151
- KOWALIK, R. M.**
Synthetic fuel effects in continuous combustion systems
An experimental study of fuel nitrogen conversion in jet-stirred combustions
[DE82-002686] p 103 N83-17646
- KRAKOWSKI, R. A.**
Utilization of the catalyzed-DD fuel cycle in Reversed-Field Pinch Reactors (RFPRs)
[DE82-010425] p 168 N83-18512
- KRAMAR, U.**
Application of energy dispersive X-ray fluorescence, ion sensitive electrodes and instrumental neutron activation in geochemical prospecting
[BMFT-FB-T-82-152] p 111 N83-18123
- KRAUTHAMER, S.**
Application of electrochemical energy storage in solar thermal electric generation systems p 47 A83-27179
- KREITH, F.**
Can industry afford solar energy p 44 A83-25144
- KREPCHEIN, I.**
Design and component testing of a low-temperature waste-heat-driven refrigeration system, phases 1 and 2
[DE82-014721] p 179 N83-21571
- KRESOVICH, S.**
The utilization of emergent aquatic plants for biomass-energy-systems development
[DE82-009174] p 124 N83-20395
- KROCHMANN, J.**
The simulation of global radiation p 37 A83-20139
- KRUEGER, G.**
Developments and applications of tantalum thin films and hybrid technology
[BMFT-FB-T-82-173] p 199 N83-17686
- KRUGER, C. H.**
Analytical investigation of axial field limitations in MHD generators p 151 A83-23126
Joule heating effects in MHD generator boundary layers p 161 A83-28956
- KRUPKA, M. C.**
The promise and status of international applications of photovoltaics
[DE82-006152] p 16 N83-18042
Impact of flywheel-energy-storage technology upon taxicab fleet operation in a large metropolitan city
[DE82-002371] p 194 N83-18591
- KUBASCO, A. J.**
Centaur gas-turbine modification and development for solar-fossil hybrid operation
[DE83-000192] p 177 N83-21366
- KUBY, O. A.**
Development of standards and a cost model for coal agglomeration and related studies
[DE82-011047] p 105 N83-17678
- KUGLER, W. R.**
Marine biomass New York state site and species study
compositional analysis and systems studies
[PB83-126078] p 142 N83-22470
- KULKARNI, S. V.**
Recent advances in composite flywheel containment design technology p 189 A83-27302
- KUMAR, K. D.**
Analysis of environmental issues related to small-scale hydroelectric development 6 Dissolved oxygen concentrations below operating dams
[DE82-007127] p 22 N83-19329
- KUMAR, K. H.**
Development of a thermodynamic properties correlation framework for the coal conversion industry, phase 2
[DE82-009866] p 148 N83-23190
- KUMARAN, A. R.**
Cross-sectional current distribution in coal fired diagonal conducting wall MHD generator p 151 A83-23130
- KUMM, W. H.**
Fuel-cell-propelled submarine-tanker-system study
[DE82-015149] p 183 N83-22827
- KUO, S. C.**
Flow distribution control characteristics in marine gas turbine waste-heat recovery system Phase 2 Flow distribution control in waste-heat steam generators
[AD-A119310] p 175 N83-20054
- KUPKE, C.**
Heat energy consumption and intermittent heating
[PB82-255159] p 8 N83-16945
- KUTSCHER, C. F.**
Design approaches for solar industrial process-heat systems Nontracking and line-focus collector technologies
[DE83-003339] p 79 N83-21620
- KUZMENKO, P. J.**
Measurement of plasma conductivity using Faraday rotation of submillimeter waves p 151 A83-23139
- KVENVOLDEN, K.**
Exploration deliberations p 144 N83-22762
- KYDES, A. S.**
Model simplification to examine the interrelationships between coal, gas and oil use
[DE82-007816] p 110 N83-18061
- KYDYRALIEVA, A. M.**
A physiological and hygienic evaluation of the work regime of operators who are working in current energy production in Kirghizia p 4 A83-28765
- L**
- LABIALE, G.**
Influence of driver behavior on fuel consumption
Bibliographic study
[IRT-58] p 11 N83-17086
- LACEWELL, R. D.**
Economic and engineering evaluation of plant oils as a diesel fuel
[DE83-900805] p 141 N83-22464
- LACKEY, M. E.**
Engineering systems analysis of pressurized fluidized-combustion power systems
[DE82-013390] p 127 N83-21083
- LAESSIG, R. R.**
The 80 megawatt wind power project at Kahuku Point, Hawaii p 172 N83-19264
- LAGONIK, F.**
Gas characterization from fluidized-bed coal gasification
[DE82-012396] p 138 N83-22357
- LAINE, E. F.**
The HFEM monitoring of coal gasification Rawlins, Wyoming
[DE82-013801] p 142 N83-22466
- LAM, S. H.**
The plasmadynamics and ionization kinetics of thermionic energy conversion
[DE82-012938] p 176 N83-20421
- LAMBERT, J.**
Motor-fuels for road vehicles
[REPT-24] p 140 N83-22440
- LAMBY, E. J.**
Catalytic effects of alkali metal salts in the gasification of coal char
[DE82-000850] p 103 N83-17645
- LAMDERS, R.**
Analysis and design of residential load centers Volume 2 Appendices
[DE82-014253] p 24 N83-19956
- LAMPE, R. F.**
The MOD-OA 200 kilowatt wind turbine generator design and analysis report
[NASA-CR-165127] p 163 N83-16859
- LANDERMAN, A. M.**
Evaluation of industrial advanced heat recovery/thermal energy storage systems
[DE82-906475] p 193 N83-18619
- LANGFELDT, S. L.**
Uranium hydrogeochemical and stream sediment reconnaissance of the St Michael NTMS quadrangle, Alaska
[DE82-009999] p 99 N83-16844
Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska
[DE82-009666] p 115 N83-19196
Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197
- LANGLEY, R.**
Sperry low-temperature geothermal conversion system Volume 1 Organic-working-fluid properties
[DE82-018529] p 163 N83-16867
- LANSING, F. L.**
Performance simulation of the JPL solar-powered distiller Part 1 Quasi-steady-state conditions p 66 N83-19781
- LAO, T. C.**
Effect of liquefaction processing conditions on combustion characteristics of solvent-refined coal
[DE82-903665] p 139 N83-22361
- LARK, R. F.**
Construction of low-cost, Mod-OA wood composite wind turbine blades
[NASA-TM-83046] p 163 N83-16857
- LARKO, D.**
Spectra over complex terrain in the surface layer
[DE83-000502] p 102 N83-17027
- LARSEN, B.**
Magnesium for hydrogen storage p 88 A83-27339
- LARSSON, L.**
Electric load of resistance heated one-family houses
An empirical analysis
[DE82-901536] p 6 N83-16923
- LARUE, R. A.**
Single and multijunction space solar cells grown by organometallic vapor phase epitaxy /OM-VPE/
p 50 A83-27260
- LATER, D. W.**
Identification and mutagenicity of nitrogen-containing polycyclic aromatic compounds in synthetic fuels
[DE82-006173] p 106 N83-17739
- LATORRE, V. R.**
Roadway-powered electric-vehicle impact study analysis of selected utility-service areas
[DE83-003143] p 180 N83-22030
Fuel-cell technology assessment Volume 2 Evaluation of Japan
[DE83-004146] p 182 N83-22771
Fuel-cell technology assessment Volume 3 Evaluation of Tunisia
[DE83-004294] p 182 N83-22772
Fuel-cell technology assessment Volume 5 Evaluation of South Korea
[DE83-004299] p 182 N83-22773
Fuel-cell technology assessment Volume 4 Evaluation of Taiwan
[DE83-004160] p 183 N83-22810
Fuel-cell technology assessment Volume 1 The potential value of US fuel-cell technology in foreign countries
[DE83-004372] p 183 N83-22820
- LAU, A. S.**
Development of residential-conservation-survey methodology for the US Air Force Task 2
[DE82-009473] p 18 N83-18077
- LAURENT, B.**
Concentrator systems in photovoltaic conversion - Assessment and perspectives p 53 A83-28653
- LAURMANN, J. A.**
Exponential growth and atmospheric carbon dioxide p 2 A83-24255
- LAWHON, J. T.**
Ethanol production in small- to medium-size facilities
[DE83-900875] p 146 N83-22807
- LAWHON, W. T.**
The utilization of emergent aquatic plants for biomass-energy-systems development
[DE82-009174] p 124 N83-20395
- LAWLESS, J. L., JR.**
The plasmadynamics and ionization kinetics of thermionic energy conversion
[DE82-012938] p 176 N83-20421
- LAWRENCE, J.**
Photochemical storage potential of azobenzenes p 191 A83-28941
- LAZARUS, G. S.**
Annual thermal performance of sunspace-type passive-solar collectors for residence heating Attached and semi-enclosed geometries
[DE83-002310] p 56 N83-16888
- LEACH, H. J.**
Maintaining automotive mobility Using fuel economy and synthetic fuels to compete with OPEC oil
[DE83-004873] p 37 N83-23245
- LEACH, J. W.**
High-temperature molten salt solar thermal systems p 51 A83-27317
- LECROY, J. E.**
Aquifer thermal-energy-storage modeling
[DE83-900672] p 197 N83-22794
- LEDBETTER, H. M.**
Physical properties data compilations relevant to energy storage Part 5 Mechanical properties data on alloys for use in flywheels
[PB82-232919] p 194 N83-18904
- LEE, D. O.**
Controlled source audio-magnetotelluric (CSMAT) resistivity measurements for in-situ combustion
[DE82-016398] p 120 N83-19877
- LEE, K.**
Design and component testing of a low-temperature waste-heat-driven refrigeration system, phases 1 and 2
[DE82-014721] p 179 N83-21571
Design of hydraulic output Stirling engine
[NASA-CR-167976] p 181 N83-22739

- LEE, L. L.**
Development of a thermodynamic properties correlation framework for the coal conversion industry, phase 2 [DE82-009866] p 148 N83-23190
- LEE, L. M.**
A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas [DE83-004095] p 135 N83-21686
- LEE, M. L.**
Identification and mutagenicity of nitrogen-containing polycyclic aromatic compounds in synthetic fuels [DE82-006173] p 106 N83-17739
- LEE, S. H. D.**
Alkali-metal-vapor removal from pressurized fluidized-bed combustor flue gas [DE82-008088] p 10 N83-16976
- LEEPER, S. A.**
Municipal-solid-waste biconversion technologies [DE83-000263] p 100 N83-16893
Design, construction, operation and costs of a modern small-scale fuel-alcohol plant [DE82-011019] p 107 N83-17754
- LEIGH, R.**
An analysis of selected surface characteristics and latent heat storage for passive solar space heating [DE82-006932] p 61 N83-18049
- LENZ, U.**
Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels [PB82-255167] p 96 N83-16459
- LEO, A.**
Assessment of phosphonic acid and trifluoromethane sulfonic acid fuel cells for vehicular powerplants p 154 A83-27162
- LEONE, J. F.**
The design and construction of a low power gas turbine for solar energy conversion - An analytical model of operation of the installation in a variable mode p 52 A83-28647
- LEPORI, W. A.**
Economic and engineering evaluation of plant oils as a diesel fuel [DE83-900805] p 141 N83-22464
Ethanol production in small- to medium-size facilities [DE83-900875] p 146 N83-22807
- LENER, J. I.**
Workshop on the Federal Role in the Commercialization of Large Scale Windmill Technology (summary and papers) [PB83-105593] p 28 N83-20438
- LESIECKI, M. L.**
Light transport in planar luminescent solar concentrators - The role of DCM self-absorption p 39 A83-22619
- LESLIE, J. C.**
An advanced electric vehicle powertrain p 154 A83-27161
- LESOTA, S. K.**
On the choice of the optimal density of vibrators for a rectenna p 184 A83-23464
- LESSARD, R. D.**
Ceramic heat-exchanger applications study [DE83-003166] p 132 N83-21529
- LESSARD, R. R.**
Catalytic coal gasification - An emerging technology for SNG [DE82-007596] p 104 N83-17676
- LESTER, T. W.**
Diffusion flame studies of the chemical and physical mechanisms of soot formation from aromatic and substituted aromatic fuels [DE82-009310] p 120 N83-19879
- LETH, J. R.**
A study of bolting problems, tools, and practices in the nuclear industry [DE82-902203] p 168 N83-19099
- LEVIN, B.**
Survey of the international development in indoor climate control [PB83-100461] p 67 N83-19962
- LEVINE, A.**
The development of solar-assisted gas-fired appliances, phase 2 [PB82-231663] p 66 N83-19312
- LEVINE, N.**
A survey of manufacturers of solar thermal energy systems [NASA-CR-169924] p 63 N83-19223
- LEVITAN, W. M.**
Gulf coast ecological inventory user's guide and information base [DE83-900406] p 28 N83-20455
- LEVY, A.**
CaO interactions in the staged combustion of coal [DE82-010299] p 103 N83-17641
- Synthetic-fuel aromaticity and staged combustion [DE82-010302] p 118 N83-19858
- LEWIS, H. E.**
Catalytic hydrogenation unit studies [DE83-003390] p 137 N83-22342
- LEWIS, P.**
Hot-gas cleanup for molten-carbonate fuel cells [DE82-002500] p 163 N83-16864
- LEWIS, S.**
The Second Conference on the Environmental Chemistry of Hydrazine Fuels [AD-A121324] p 13 N83-17731
- LIBERMAN, A.**
New priorities in energy-conservation research and development [DE82-005988] p 16 N83-18054
- LIEB, D.**
Thermionic converters for terrestrial applications p 159 A83-27299
Cogeneration using a thermionic combustor p 159 A83-27300
Solar thermionic energy converter experiment p 51 A83-27301
- LIEBER, M. D.**
Study of vacuum systems for a heat engine/flywheel automotive propulsion system [DE83-002284] p 198 N83-23244
- LIEN, S.**
Photobiology task of the advanced solar energy research program [DE82-012310] p 71 N83-20417
- LIMAYE, D. R.**
Transportation network models for energy supply analysis Volume 1 Executive summary [DE82-903077] p 187 N83-20399
Transportation network models for energy supply analysis Volume 3 Transportation network model user's guide and documentation [DE82-903079] p 187 N83-20400
- LIN, E. I. H.**
Regional thermal and electric energy output of salt-gradient solar ponds in the U S [ASME PAPER 82-WA/SOL-27] p 44 A83-25689
- LIN, R. J. H.**
Optimization of solar-selective paint coatings [DE83-001278] p 80 N83-21642
- LIN, W. L.**
The implications of a stochastic approach to air-quality regulations [DE83-001636] p 9 N83-16972
- LINKOHR, R.**
Development of gas-phase metallized plaques for electrodes of storage batteries, in particular for nickel oxide electrodes [PB82-255431] p 193 N83-16950
- LINTHORST, S. J. M.**
Numerical calculation of the heat transfer by natural convection in a cubical enclosure p 42 A83-23212
- LINVILLE, B.**
Liquid fossil-fuel technology [DE83-002501] p 121 N83-19937
- LIPNER, M. H.**
The MOD-OA 200 kilowatt wind turbine generator design and analysis report [NASA-CR-165127] p 163 N83-16859
- LIPPE, W.**
Solar energy plant as a complement to a conventional heating system Measurement of the storage and consumption of solar energy [PB82-255209] p 59 N83-16946
- LIPSCHULTZ, R.**
Spectra over complex terrain in the surface layer [DE83-000502] p 102 N83-17027
- LIRIA, N.**
A semiconductor-insulator-semiconductor CdO-SiO₂-Si solar cell p 41 A83-22912
- LISCINSKY, D. S.**
Chemical effects in vaporizing synthetic fuels [DE82-003352] p 96 N83-16549
- LISKOWITZ, J. W.**
Leachate-treatment technique utilizing fly ash as low-cost sorbent [DE82-010501] p 111 N83-18101
- LITKA, A. H.**
Innovative photovoltaic application for residences experiment [DE83-000399] p 57 N83-16898
- LITT, R. D.**
Advanced atmospheric fluidized-bed combustion design Ultrahigh velocity [DE83-004819] p 128 N83-21088
- LIU, A. Y.**
Solar/gas Brayton/Rankine cycle heat pump assessment [PB83-102319] p 67 N83-19963
- LIU, B. C.**
A technology assessment of solar energy systems Direct combustion of wood and other biomass in industrial boilers [DE83-000937] p 31 N83-21538
- LIU, B. L.**
Cross-sectional current distribution in coal fired diagonal conducting wall MHD generator p 151 A83-23130
- LIU, C. C.**
The electrochemical fluorination of polymers materials for high energy density aqueous and non-aqueous battery and fuel cell separators [NASA-CR-167961] p 177 N83-21056
- LIU, D. D. S.**
Laminar burning velocities of hydrogen-air and hydrogen-air-steam flames p 85 A83-19837
- LIVRAGHI, M.**
Evaluation of deterioration due to hot creep in chrome-molybdenum ferritic steels used in thermal power stations [BLL-CE-TRANS-7669-(9022 09)] p 162 N83-16470
- LOBITZ, D. W.**
Finite-element analysis and modal testing of a rotating wind turbine [DE83-002609] p 180 N83-21608
- LODES, R.**
Enlargement of the raw material basis of refineries by including hard coal Pilot plant for coal hydrogenation, construction phase [BMFT-FB-I-82-192] p 126 N83-21054
- LOEBL, A. S.**
Energy-data validation An overview and some concepts [DE82-020901] p 27 N83-20431
- LOFERSKI, J. J.**
Research on application of Arc-Plasma Spraying (APS) [DE82-015220] p 70 N83-20408
- LOFGREN, B. E.**
Monitoring well systems in geothermal areas [DE82-012770] p 133 N83-21586
- LOHR, B.**
Enlargement of the raw material basis of refineries by including hard coal Pilot plant for coal hydrogenation, construction phase [BMFT-FB-I-82-192] p 126 N83-21054
- LOMAKIN, A. N.**
On the orientation precision of satellite solar power stations p 41 A83-23164
- LONEY, J. M.**
Programmatic environmental overview Biomass fuels program [DE82-906065] p 101 N83-16975
- LONG, E. C., JR.**
The implications of a stochastic approach to air-quality regulations [DE83-001636] p 9 N83-16972
- LONG, J.**
The growth of Zn3P2 by metalorganic chemical vapor deposition p 45 A83-26065
- LONG, L. J.**
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model [DE83-004004] p 197 N83-22758
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, Part 1 Turbomachinery design [DE83-004005] p 197 N83-22759
- LONG, P. J. G.**
Back-to-back test for determining the pumping losses in a Stirling cycle machine p 158 A83-27290
- LONG, W. F.**
Assessment of research directions for high-voltage direct-current power systems [DE83-001118] p 177 N83-21247
- LONGANBACH, J. R.**
Synthetic-fuel aromaticity and staged combustion [DE82-010302] p 118 N83-19858
- LONGSTREET, E. J.**
Assessment of battery buses and battery technology [PB82-260019] p 11 N83-17428
- LONGWELL, J. P.**
Coal pyrolysis by hot solids from a fluidized-bed combustor [DE83-003344] p 117 N83-19829
Coal-gasification and tar-conversion reactions over calcium oxide [DE82-014635] p 139 N83-22358
- LOORAM, M. E.**
A study of bolting problems, tools, and practices in the nuclear industry [DE82-902203] p 168 N83-19099
- LORD, G.**
Hot-gas cleanup for molten-carbonate fuel cells [DE82-002500] p 163 N83-16864

- LORETH, M.**
Study to establish cost predictions for the production of Redox chemicals [NASA-CR-167882] p 194 N83-20359
- LOVE, S. L.**
Characterization and supporting research for in-situ coal-gasification research and development project plan [DE83-000962] p 101 N83-16910
Site selection and characterization for an underground coal gasification test in Washington State Volume 2 Project details [DE82-010948] p 19 N83-18117
- LOWDERMILK, W. H.**
Coatings for laser fusion [DE82-005698] p 165 N83-17330
- LOWELL, C. E.**
Critical research and advanced technology (CRT) support project [NASA-TM-83019] p 123 N83-20361
- LOZIEV, V. P.**
Results of the investigation of the oil and gas deposits of Tadzhikistan on the basis of space photographs p 94 A83-26805
- LUCARELLI, B.**
Methods for evaluating the DOE Appropriate-Technology Program A review and compilation of evaluation methods [DE83-003306] p 145 N83-22781
- LUCAS, W. C.**
Conceptual design of the 6 MW Mod-5A wind turbine generator p 173 N83-19271
- LUCERO, F. J., JR.**
Energy development on Native American lands Resources and attitudes An interpretive report on two major Indian conferences of 1980 [DE82-009539] p 17 N83-18076
- LUDOWISE, M. J.**
Single and multijunction space solar cells grown by organometallic vapor phase epitaxy /OM-VPE/ p 50 A83-27260
- LUJAN, R.**
Effect of an SiC layer on p-n amorphous silicon solar cells p 40 A83-22909
- LURIA, M.**
The seasonal variation of the atmospheric SO₂ to SO₄⁻ conversion rate p 2 A83-24279
- LURIE, M. S.**
Further development of the fluidyne liquid-piston engine p 156 A83-27275
- LUSAS, E. W.**
Economic and engineering evaluation of plant oils as a diesel fuel [DE83-900805] p 141 N83-22464
- LUZA, K. V.**
Geothermal resource assessment in Oklahoma [DE82-021288] p 100 N83-16874
- LYNCH, F.**
A clean internal combustion engine for underground mining machinery A technical assessment and program plan, phase 1 [PB82-244724] p 89 N83-19104
- LYNN, D. K.**
Acid fuel cell technologies for vehicular power plants p 154 A83-27185
- LYTLE, R. J.**
A brief overview of geophysical probing technology [DE82-011217] p 19 N83-18133
- M**
- MABON, J. C.**
Thermal degradation of solar collector surfaces p 44 A83-25535
- MACFARLANE, R.**
Laminar burning velocities of hydrogen-air and hydrogen-air-steam flames p 85 A83-19837
- MADER, J.**
Contemporary electric vehicle testing and evaluation p 3 A83-27160
- MAGEE, W. A.**
Solar array power management p 46 A83-27148
- MAGLEBY, E. H.**
Status of DOE small hydropower (CSMAT) research and development projects [DE83-001353] p 125 N83-20434
- MAGNUSSON, R.**
A wind-diesel energy system for Grimsey, Iceland p 150 A83-22021
- MAHAN, A. H.**
Amorphous silicon bibliography update - Introduction p 41 A83-22915
- MAHAPATRA, P. K.**
Photoelectrochemical behaviour of electrodeposited and pressure-sintered Bi₂S₃, Bi₂S₃-PbS and Bi₂S₃-Ag₂S semiconductor electrodes p 40 A83-22905
- MAHONEY, P. C.**
Data report for the Northeast Residential Experiment Station, October 1981 [DE82-007648] p 61 N83-18044
- MAISH, A.**
Design, testing, and economics of a 430 W sub p photovoltaic concentrator array for non grid-connected applications [DE82-014687] p 68 N83-20388
- MAKINEN, R.**
SNG from land-based biomass 1981 program [PB83-10487] p 125 N83-20440
- MAKINEN, R. W.**
Manne biomass New York state site and species study compositional analysis and systems studies [PB83-126078] p 142 N83-22470
- MAJIEVSKII, A. D.**
The kinetics and mechanism of the reaction of ozone with sulphides [BLL-OA-TRANS-1934-(6196 3)] p 94 N83-16411
- MALONE, R. D.**
Methane Hydrates Workshop Technical Proceedings [DE83-000580] p 147 N83-22825
- MALONEY, M. D.**
Environmental impacts of undergrounding high-voltage transmission. Health and safety [DE82-010108] p 186 N83-18102
- MAMBETALIEV, B. S.**
A physiological and hygienic evaluation of the work regime of operators who are working in current energy production in Kirghizia p 4 A83-28765
- MANCUS, J.**
Geothermal Energy: Tomorrow's Alternative Today A handbook for geothermal-energy development in Delaware [DE83-002987] p 35 N83-22782
- MANN, I. B.**
Optical properties of sputtered Si H [DE82-007072] p 62 N83-18491
- MANNE, A. S.**
International Energy Workshop, 1981 [DE82-021183] p 36 N83-22816
- MANNHEIMER, R. J.**
Degradation and characterization of antimisting kerosene p 92 A83-24035
Degradation and characterization of antimisting kerosene (AMK) [MED-132] p 120 N83-19922
- MANNING, P. T.**
The environmental impact of the use of large wind turbines p 4 A83-27867
- MANOS, D. M.**
Effect of molecular structure on incipient soot formation p 90 A83-19847
- MANZO, M. A.**
Cross-linked polyvinyl alcohol films as alkaline battery separators p 149 A83-20576
- MARA, G.**
Putting renewable energy to work in cities [DE82-016178] p 27 N83-20427
- MARI, J.-L.**
Interpolation and transformations of maps p 94 A83-28632
- MARIANO, C.**
Design and component testing of a low-temperature waste-heat-driven refrigeration system, phases 1 and 2 [DE82-014721] p 179 N83-21571
- MARINACCI, D. J.**
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model [DE83-004004] p 197 N83-22758
Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, Part 1 Turbomachinery design [DE83-004005] p 197 N83-22759
- MARINOV, N. A.**
Hydrogeologic studies abroad p 92 A83-25247
- MARSHALL, B. W.**
Operational experiences of a downhole steam generator [DE82-010161] p 100 N83-16906
Controlled source audio-magnetotelluric (CSMAT) resistivity measurements for in-situ combustion [DE82-016398] p 120 N83-19877
- MARSHALL, R. N.**
Assessment of distributed photovoltaic electric-power systems [DE83-900531] p 75 N83-21558
Assessment of distributed photovoltaic electric-power systems [DE83-900566] p 187 N83-22788
- MARSHALLA, R. A.**
Integrated forecasting model synthetic fuels study Volume 1 Overview and findings [DE82-903574] p 121 N83-19943
- MARTENEY, P. J.**
Experimental study of the thermal stability of hydrocarbon fuels [NASA-CR-168027] p 105 N83-17728
- MARTIN, P. M.**
Optical properties of sputtered SiH [DE82-007072] p 62 N83-18491
- MARTIN, R.**
SOLERAS solar active cooling field test operations p 48 A83-27239
- MARTINELLI, R. M.**
Solar array power management p 46 A83-27148
- MARTINENGO, P. C.**
Fiat researchers study ceramics applications in diesels p 199 N83-17760
- MARTINEZ-DUART, J. M.**
Reactive sputtered Ta₂O₅ antireflection coatings p 52 A83-27984
- MARTINEZ, E.**
Artery heat pipes for space power systems p 185 A83-27128
- MARTINEZ, H. E.**
Development of high-temperature liquid metal heat pipes for isothermal irradiation assemblies p 185 A83-27129
- MARTINI, W. R.**
Whence Stirling engines p 156 A83-27265
Whither Stirling engines p 156 A83-27266
An isothermal second-order Ringbom-Stirling engine computer program p 157 A83-27281
- MARTNER, B. E.**
Wind characteristics in Southern Wyoming p 150 A83-20802
- MARU, H. C.**
Coating applications for the molten carbonate fuel cell p 153 A83-25538
- MARWITZ, J. D.**
Wind characteristics in Southern Wyoming p 150 A83-20802
- MASSA, A.**
A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas [DE83-004095] p 135 N83-21686
- MASSEY, M. J.**
Formation/decomposition of condensable hydrocarbons during the gasification of coal [DE82-014493] p 119 N83-19866
- MASSMANN, L. A.**
Fuel/engine/airframe trade-off study Operational effects of increased freeze point fuels [AD-A121688] p 129 N83-21169
- MAST, R. F.**
US petroleum exploration Likely targets 1980 - 2000 p 112 N83-18141
- MASTERS, L. W.**
Outdoor exposure tests of solar absorptive coatings [PB83-124560] p 84 N83-22840
- MASTERSON, P. M.**
Design approaches for solar industrial process-heat systems Nontracking and line-focus collector technologies [DE83-003339] p 79 N83-21620
- MATHEY, R. G.**
Hail impact testing procedure for solar collector covers [PB83-104745] p 84 N83-22841
- MATHUR, A. K.**
Solar energy system performance evaluation Honeywell OTS 41, Shenandoah (Newman), Georgia [DE82-021004] p 73 N83-21521
Solar-energy-system performance evaluation Honeywell OTS 44, Ocmulgee, Georgia [NASA-CR-170031] p 74 N83-21530
- MATSUMURA, M.**
Photoelectrolysis of water under visible light with doped SrTiO₃ electrodes p 38 A83-20580
- MATTHEWS, W. A.**
Optical measurements p 66 N83-19567
- MATULA, R. A.**
Shock initiated ignition in heptane-oxygen-argon mixtures p 93 A83-26198
- MAX, C. E.**
Laser-plasma interaction experiments at laser wavelengths of 1.064 micron, 0.532 micron and 0.355 micron [DE82-013992] p 175 N83-20114
- MAXWELL, C. R.**
Central receiver test facility assembly building [DE82-010853] p 76 N83-21567
- MAY, E. K.**
Flow instability during direct steam generation in a line-focus solar-collector system [DE82-012887] p 70 N83-20404

- Steam generation in line-focus solar collectors A comparative assessment of thermal performance, operating stability and cost issues [DE82-014531] p 76 N83-21568
- Design approaches for solar industrial process-heat systems Nontracking and line-focus collector technologies [DE83-003339] p 79 N83-21620
- MAY, H.**
Possibilities of improving exhaust emissions and energy consumption in mixed hydrogen-gasoline operation p 87 N83-27334
- MAZARIS, G. A.**
Screen printed interdigitated back contact solar cell [NASA-CASE-LEW-13414-1] p 68 N83-20374
- MCATEE, R. E.**
Design, construction, operation and costs of a modern small-scale fuel-alcohol plant [DE82-011019] p 107 N83-17754
- MCBREEN, J.**
Current research in advanced water electrolysis in the United States and abroad p 87 N83-27216
- Nickel-zinc batteries [DE83-000208] p 197 N83-22770
- MCCABE, T. F.**
Integration of Wind Turbine Generation (WTG) into utility generating systems p 171 N83-19249
- Economics of wind energy for utilities p 116 N83-19270
- MCCANDLESS, F. P.**
Catalytic hydrogenation of coal-derived liquids [DE83-003582] p 126 N83-21068
- MCCANN, J. F.**
Factors affecting the efficiency of chemically deposited CdSe based photoelectrochemical cells p 54 N83-29514
- MCCARRON, R.**
A zinc paste primary battery p 153 N83-26052
- MCCARTHY, D. M.**
Programmatic environmental overview Biomass fuels program [DE82-906065] p 101 N83-16975
- MCCHESENEY, H. R.**
Evaluation of industrial advanced heat recovery/thermal energy storage systems [DE82-906475] p 193 N83-16919
- MCCHESENEY, M. A.**
Optimization of solar-selective paint coatings [DE83-001278] p 80 N83-21642
- MCCONNELL, P. M.**
Fuel/engine/airframe trade-off study Operational effects of increased freeze point fuels [AD-A121688] p 129 N83-21169
- MCCORMICK, J. B.**
Acid fuel cell technologies for vehicular power plants p 154 N83-27185
- MCCORMICK, T. P. E., JR.**
Geothermal data for 95 thermal and nonthermal waters of the Valles Caldera, southern Jemez Mountains region, New Mexico [DE82-017397] p 130 N83-21496
- MCCRARY, G. E.**
Solar thermochemical energy conversion and transport [AD-A121318] p 64 N83-19276
- MCCRARY, J. H.**
Solar thermochemical energy conversion and transport [AD-A121318] p 64 N83-19276
- MCCREA, J.**
Manufacture and testing of fibre composite rotor components /Fibre composite flywheel development program for road vehicle applications/ p 190 N83-27308
- MCDOWELL, R. S.**
Solar altitude frequency tables p 39 N83-22617
- MCLEHINEY, J. E.**
Reservoir engineering transient pressure well testing, and petrophysical analyses of western gas sands [DE82-004879] p 99 N83-16839
- MCLEROY, J. F.**
Status of solid polymer electrolyte fuel cell technology and potential for transportation applications p 154 N83-27186
- MCFARLAND, R. D.**
Annual thermal performance of sunspace-type passive-solar collectors for residence heating Attached and semi-enclosed geometries [DE83-002310] p 56 N83-16888
- MCFARLIN, D. J.**
Ceramic heat-exchanger applications study [DE83-003166] p 132 N83-21529
- MCGEE, M. J.**
Energy efficient industrial technology in Europe A compendium [PB83-102327] p 28 N83-20442
- MCGUINNESS, T.**
Some ocean engineering considerations in the design of OTEC plants p 155 N83-27224
- MCGUIRE, P. L.**
Methand hydrate gas production An assessment of conventional production technology as applied to hydrate gas recovery [DE82-006746] p 107 N83-17742
- Recovery of gas from hydrate deposits using conventional production technology [DE82-008106] p 145 N83-22775
- MCHALE, E. T.**
Further development and evaluation of coal-water mixture technology [DE82-010518] p 106 N83-17736
- MCINTEER, C.**
Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska [DE82-009666] p 115 N83-19196
- MCKEE, D. W.**
Catalytic effects of alkali metal salts in the gasification of coal char [DE82-000850] p 103 N83-17645
- MCKENZIE, A. W.**
Cost and performance of thermal storage concepts in solar thermal systems, Phase 2-liquid metal receivers p 51 N83-27316
- MCKINLEY, J. B.**
The analysis of integrated gas efficient, low noise procedures in lax terminal area operations p 11 N83-17459
- MCKINNON, J. T.**
Reformed methanol [DE83-002096] p 129 N83-21176
- MCMAHON, J. E.**
Residential end use demand modeling Improvements to the ORNL model [DE82-004925] p 13 N83-17750
- MCMLLEN, D. F.**
Exploratory study of coal conversion chemistry [DE82-013414] p 138 N83-22354
- MCMONAGLE, C. A.**
Analytical modeling of a hydraulically-compensated compressed-air energy-storage system [DE83-005708] p 197 N83-21640
- MCNEESE, L. E.**
Fossil energy program [DE82-007496] p 111 N83-18082
- Fossil-energy program [DE82-007502] p 111 N83-18083
- MCNEILL, B. W.**
Performance of an experimental photovoltaic-powered house [DE82-000662] p 58 N83-16908
- MCNICOL, B. D.**
Nickel-zinc batteries [DE83-000208] p 197 N83-22770
- MCPERSON, B.**
Putting renewable energy to work in cities [DE82-016178] p 27 N83-20427
- MCWHIRTER, D. A.**
Experimental techniques for the study of photosynthetic water splitting [DE82-003974] p 89 N83-17668
- MEAD, W. C.**
Laser-plasma interaction experiments at laser wavelengths of 1 064 micron, 0 532 micron and 0 355 micron [DE82-013992] p 175 N83-20114
- MEAGHER, J. F.**
The seasonal variation of the atmospheric SO₂ to SO₄⁻ conversion rate p 2 N83-24279
- MEARES, L. G.**
High-efficiency spacecraft power conversion techniques p 45 N83-27135
- MEDNICK, R. L.**
Liquid-phase methanol process development unit Installation, operation, and support studies [DE82-012725] p 121 N83-19940
- MEHALICK, E. M.**
Analysis and design of residential load centers Volume 2 Appendices [DE82-014253] p 24 N83-19956
- Design of a photovoltaic system for a southeast all-electric residence [DE82-009349] p 69 N83-20394
- MEHTA, A. K.**
Effect of liquefaction processing conditions on combustion characteristics of solvent-refined coal [DE82-903665] p 139 N83-22361
- MEHTA, B. R.**
On-site production of electrolytic hydrogen for generator cooling p 86 N83-27209
- MEI, H. T.**
Ventilated wall and window test passive-solar concept [DE83-900824] p 78 N83-21614
- MEIJER, R. J.**
A new, versatile Stirling energy conversion unit p 157 N83-27280
- MEINEL, A. B.**
Performance optimization of the ASR optical module [DE83-004477] p 82 N83-22797
- MEINEL, E.**
Performance optimization of the ASR optical module [DE83-004477] p 82 N83-22797
- MEINEL, W.**
Performance optimization of the ASR optical module [DE83-004477] p 82 N83-22797
- MELIKIAN, G.**
Solar/gas Rankine/Rankine-cycle heat pump assessment [PB82-254863] p 55 N83-16710
- MENGELKAMP, H. T.**
Simulation of air-pollution propagation resulting from at-sea incineration wastes [DE83-902297] p 10 N83-16979
- MENZIE, W. R.**
Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States [DE82-011237] p 18 N83-18108
- MENZIES, W. R.**
Acid rain mitigation study Volume 1 FGD cost estimates [PB83-101329] p 29 N83-20459
- Acid rain mitigation study Volume 2 FGD cost estimates, appendices [PB83-117366] p 29 N83-20469
- MERCER, J. E.**
Development of a quiet Stirling cycle multi-fuel engine for electric power generation [AD-A121033] p 174 N83-19278
- MERRIGAN, M.**
Artery heat pipes for space power systems p 185 N83-27128
- MERRILL, O.**
Thermionic technology infrastructure for space power p 159 N83-27298
- MERRYMAN, E. L.**
CaO interactions in the staged combustion of coal [DE82-010299] p 103 N83-17641
- MERSON, B.**
Advanced photovoltaic-trough development [DE82-015646] p 77 N83-21584
- MERTEN, G. P.**
On-site fuel cell field test support program [PB83-121723] p 28 N83-20439
- MERTENS, R.**
High efficiency p+/n-n/n+/n- back-surface field silicon solar cells with very large short-circuit current densities p 41 N83-22913
- Progress in photovoltaic energy conversion p 42 N83-23859
- Metal-insulator-semiconductor silicon solar cells p 44 N83-25447
- MESSIDORO, P.**
A heat pipe simulation technique for spacecraft thermal testing under variable orientation [SAE PAPER 820860] p 185 N83-25760
- MESSNER, A.**
Development of management technology for large power systems p 46 N83-27147
- METWALLY, A. W.**
Generic environmental and safety assessment of 5 battery energy-storage systems [DE82-902212] p 23 N83-19334
- MEYER, L. O.**
Manufacturing comparisons of aviation and motor gasolines p 141 N83-22448
- MEYER, M. A.**
A data-gathering method for use in modeling energy research, development and demonstration programs [DE82-006153] p 16 N83-18040
- MEYER, R. D.**
Energy-transmission-system heat losses [DE83-003628] p 187 N83-22786
- MEYERS, P. S.**
Fuel-composition and -vaporization effects on combustion-chamber deposits [DE82-012576] p 104 N83-17670
- MEZZINA, A.**
Current research in advanced water electrolysis in the United States and abroad p 87 N83-27216
- MICHAELS, D.**
Large area, low cost solar cell development and production readiness [NASA-CR-170037] p 73 N83-21512

- MICHALAK, S.**
Development of heat exchangers for reheating scrubbed flue gas in a pilot plant
[BMFT-FB-T-82-169] p 13 N83-17840
- MICHALOPOULOS, P. G.**
Development and implementation of dynamic methodologies for evaluating energy conservation strategies
[PB82-240763] p 21 N83-19304
Development and implementation of dynamic methodologies for evaluating energy conservation strategies Executive summary
[PB82-240771] p 21 N83-19305
- MICHEELS, R. H.**
Use of inorganic materials for phosphorescent concentrating solar cells
[DE83-002860] p 83 N83-22799
- MICHEL, A.**
Continuously adjustable low-power gasifier burner/boiler system
[BMFT-FB-T-82-038] p 131 N83-21507
- MIDDLETON, J. W.**
The effects of atmospheric variability on energy utilization and conservation
[DE83-003612] p 31 N83-21525
- MIENTEK, A. P.**
On-site fuel cell power plant technology development program
[PB83-102335] p 176 N83-20437
- MIGLIORE, P. G.**
Aerodynamic tests of Darrieus wind turbine blades
p 151 A83-23128
- MILLER, A. H.**
Long-term energy capture and the effects of optimizing wind turbine operating strategies p 171 N83-19248
- MILLER, G.**
Workshop on the Federal Role in the Commercialization of Large Scale Windmill Technology (summary and papers)
[PB83-105593] p 28 N83-20438
- MILLER, J. L.**
Electric power - Looking at regenerative systems
p 43 A83-24353
- MILLER, W.**
Experimental and theoretical studies of Cu₂O solar cells
p 40 A83-22907
- MILLER, W. C.**
Oil shale project run summary small retort run S-7
[DE82-004731] p 99 N83-16837
- MILLNER, A.**
Design and fabrication of a prototype system for photovoltaic residences in the southwestern United States
[DE83-002532] p 78 N83-21607
- MILSTEIN, J. B.**
Influence of grain boundaries on solar cell performance
[DE82-004662] p 56 N83-16881
- MINCEY, J. F.**
Economic incentives for additional critical experimentation applicable to fuel dissolution
[DE82-006818] p 106 N83-17737
- MINEGISHI, T.**
A study on the hydrogen-oxygen diffusion flame in high speed flow
p 93 A83-26199
- MINES, G. L.**
Performance and operational experience of a prototype binary geothermal power plant
[DE82-006289] p 164 N83-16901
- MINGLE, J. G.**
Effect of low-proof alcohol fumigation-fueling on crankcase oil dilution in a diesel-cycle engine
[DE83-002976] p 122 N83-20171
- MINOR, M. M.**
Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska
[DE82-009666] p 115 N83-19196
- MINOURA, H.**
Electrochemically deposited CdS and CdSe anodes for photoelectrochemical cells
p 149 A83-19883
- MISKOLCZY, G.**
Thermionic technology infrastructure for space power
p 159 A83-27298
Cogeneration using a thermionic combustor
p 159 A83-27300
- MITCHELL, B. M.**
Future analysis, forecasting and planning for telecommunications, energy and public utilities
[RAND-P-6796] p 20 N83-18978
- MITCHELL, D. H.**
Steam gasification of wood in the presence of catalysts
[DE82-005919] p 162 N83-16557
- Methanol synthesis gas from catalytic steam reforming of wood
[DE82-006082] p 106 N83-17734
Catalyst behavior in biomass gasification
[DE82-006164] p 110 N83-18057
Catalytic gasification of biomass
[DE82-005877] p 110 N83-18058
- MITCHELL, J. W.**
i-Chart - Predictions and measurements
p 42 A83-23880
- MITOFF, S. P.**
Development of advanced batteries for utility application
[DE82-906459] p 193 N83-16918
- MIXON, W. R.**
District heating and more-efficient buildings
[DE81-025437] p 26 N83-20379
- MIYASE, A.**
Manufacture and testing of fibre composite rotor components /Fibre composite flywheel development program for road vehicle applications/
p 190 A83-27308
- MOBARAK, A.**
Large parabolic dish collectors with small gas-turbine, Stirling engine or photovoltaic power conversion systems
p 160 A83-27329
- MOHR, D. H., JR.**
Identification and removal of the organic compounds in coal-conversion condensate waters
[DE82-004825] p 8 N83-16955
- MOIZER, A. D.**
Convective heat losses from flat-plate solar collectors in turbulent winds
p 43 A83-23883
- MOJOLA, O. O.**
On aerodynamic design of the Savonius windmill rotor
p 160 A83-27325
- MOLT, W.**
A highly efficient collector for small solar energy installations
[PB82-255191] p 60 N83-16948
- MOLOSE, Y.**
50 kW Stirling engine
p 157 A83-27282
- MONISMITH, C. L.**
Research in transportation engineering in the United States
p 37 N83-23208
- MONOSTORY, F. P.**
Desulphurisation of solid fuels in power stations by superconductive magnets
[BLL-CE-TRANS-7855-(9022 09)] p 125 N83-21051
- MONTELLONE, A.**
Economic feasibility of solar thermal industrial applications and selected case studies
[DE82-009503] p 66 N83-19303
- MONTEMAYOR, A. F.**
Fuel property effects on diesel engine and gas turbine combustor performance
[AD-A120879] p 175 N83-20161
- MONTERO, A. R.**
Research, development and demonstration of an advanced actuated heat pump
[PB82-254590] p 164 N83-16932
- MONTOYA, P. C.**
Controlled source audio-magnetotelluric (CSMAT) resistivity measurements for in-situ combustion
[DE82-016398] p 120 N83-19877
- MOORE, A. E.**
Design, fabrication, and initial testing of solar one receiver
p 47 A83-27229
- MOORE, D. S.**
Economic and engineering evaluation of plant oils as a diesel fuel
[DE83-900805] p 141 N83-22464
- MOORE, J. L.**
The comprehensive community energy management program. An evaluation
[DE82-011552] p 17 N83-18060
- MOORE, O. E.**
Design and demonstration of a spectrum-splitting photovoltaic concentrator module
[DE83-003669] p 79 N83-21634
- MOORE, S. W.**
Solar-absorber-selective paint research
[DE82-006104] p 61 N83-18050
- MORECRAFT, L. M.**
Synthetic fuels for transportation Background paper 1 The future potential of electric and hybrid vehicles
[PB83-126086] p 37 N83-23250
- MOREIRA, A. R.**
Methanol production from fermentor off-gases
[DE83-005011] p 145 N83-22793
- MORGAN, P.**
Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703
- MORGEN, G. P.**
Design of highwall mining equipment electronic guidance package
[DE82-006115] p 108 N83-18005
- MORIARTY, R.**
Rankine/Rankine cycle gas-fired heat pump
[PB82-254640] p 165 N83-16944
- MORRALL, J. C.**
Fuel conservation and economy constraints
p 34 N83-22179
- MORRIS, C. J.**
Chemical characterization of organic contaminants in groundwater near an underground coal gasification site
[DE82-004822] p 8 N83-16956
- MORRIS, J. F.**
Direct-energy-conversion implications of space nuclear reactors
p 159 A83-27297
Heat pipes containing alkali metal working fluid
[NASA-CASE-LEW-12253-1] p 186 N83-19596
- MORRIS, V. L.**
Solar-collector materials exposure to the IPH site environment Task 5 0
[DE83-002192] p 62 N83-18072
- MORRISON, D.**
Development of an advanced solar augmented water heater (for single family home applications)
[PB83-119610] p 84 N83-22842
- MORRISON, L.**
Comparison of heat pump water heaters and solar domestic water heaters
[DE82-006117] p 61 N83-18046
- MORSE, R. L.**
Solar-collector silicon hose life test
[DE83-002236] p 83 N83-22798
- MOUSSA, N. A.**
Ignition sources of LNG vapor clouds
[PB82-262577] p 96 N83-16461
- MOYLE, R. A.**
Assessment of distributed solar power systems Issues and impacts
[DE83-900640] p 78 N83-21618
- MOYNIHAN, P. I.**
Applications guide for waste heat recovery
[NASA-CR-170121] p 178 N83-21511
- MOYNIHAN, T. M.**
Effects of displacer seal clearance on free-piston Stirling engine performance
p 158 A83-27295
- MUBAYI, V.**
Energy planning for development Needs and approaches
[DE82-014180] p 26 N83-20420
- MUDGE, L. K.**
Steam gasification of wood in the presence of catalysts
[DE82-005919] p 162 N83-16557
Methanol synthesis gas from catalytic steam reforming of wood
[DE82-006082] p 106 N83-17734
Catalyst behavior in biomass gasification
[DE82-006164] p 110 N83-18057
Catalytic gasification of biomass
[DE82-005877] p 110 N83-18058
- MUELLER, A.**
Simulation of air-pollution propagation resulting from at-sea incineration wastes
[DE82-902297] p 10 N83-16979
- MULAC, A. J.**
Project DEEP STEAM
[DE82-010945] p 111 N83-18078
- MULHOLLAND, G. P.**
Solar furnace for flux gage calibration and thermal-effects testing
[DE82-005769] p 62 N83-18062
- MULHOLLAND, P. J.**
Using peat for energy Potential environmental restraints Overview
[DE82-005201] p 5 N83-16876
- MULLENHOFF, D. J.**
Route profile analysis to determine suitability of electric postal-delivery vehicles
[DE82-012216] p 29 N83-20842
- MULLIN, J. P.**
The NASA program in Space Energy Conversion Research and Technology
p 160 A83-27326
- MUNRO, M. B.**
Fibre composite rotor selection and design /Fibre composite flywheel development program for road vehicle applications/
p 190 A83-27307
Manufacture and testing of fibre composite rotor components /Fibre composite flywheel development program for road vehicle applications/
p 190 A83-27308
- MURAYAMA, Y.**
R and D of energy saving and new energy utilization in Japanese marine engineering
p 4 A83-27225

MURDOCH, A.

- MURDOCH, A.**
Control design for a wind turbine-generator using output feedback p 152 A83-24721
Control design and performance analysis of a 6 MW wind turbine-generator p 162 A83-29897
- MURPHY, J. A.**
Interim Reliability Evaluation Program (IREP) [DE82-004132] p 5 N83-16777
- MURPHY, L. M.**
Steam generation in line-focus solar collectors: A comparative assessment of thermal performance, operating stability and cost issues [DE82-014531] p 76 N83-21568
- MURRAY, E. M.**
An optimization of monolithic photovoltaic series arrays p 38 A83-20751
- MURRAY, H. S.**
Feasibility evaluation of fuel cells for selected heavy-duty transportation systems [DE83-002953] p 179 N83-21550
- MURRAY, S. P.**
The effects of weather systems, currents and coastal processes on major oil spills at sea [AD-A120221] p 8 N83-16953
- MURTHY, B.**
Fuel quality-processing study Volume 2. Literature survey [NASA-CR-165326-VOL-2] p 143 N83-22751
- MURTHY, R.**
Parametric analysis of closed cycle magnetohydrodynamic (MHD) power plants [NASA-CR-165472] p 182 N83-22748
- MUTHIG, P. J.**
A study of the United States coal resources [NASA-CR-169792] p 101 N83-16993
- MUTONE, G. A.**
Multiple and variable speed electrical generator systems for large wind turbines p 170 N83-19236
- MYBURGH, I. S.**
Propanol-plus as extender to diesel fuel [CSIR-ME-445] p 128 N83-21165
A study of possible detrimental effects on internal combustion engines by the combustion of gasoline blends [CSIR-ME-446] p 129 N83-21166

N

- NACK, H.**
Advanced atmospheric fluidized-bed combustion design Ultrahigh velocity [DE83-004819] p 128 N83-21088
- NAEGELI, D. W.**
Fuel property effects on diesel engine and gas turbine combustor performance [AD-A120879] p 175 N83-20161
- NAINGER, J. J.**
Critical research and advanced technology (CRT) support project [NASA-TM-83019] p 123 N83-20361
- NAJJAR, Y. S. H.**
Radiation and smoke from the gas turbine combustor using heavy fuels p 92 A83-23877
- NAKAHARA, K.**
Sodium-sulfur battery program in Japan p 189 A83-27175
- NAKLES, D. V.**
Formation/decomposition of condensable hydrocarbons during the gasification of coal [DE82-014493] p 119 N83-19866
- NALBANDIAN, S. J.**
Design of large, low-concentration-ratio solar arrays for low earth orbit applications p 49 A83-27254
Low concentration ratio solar array for low Earth orbit multi-100 kW application [NASA-CR-170729] p 67 N83-20360
- NANIS, L.**
Workshop on the Status of Industrial Organic Electrochemistry, summary [DE82-901982] p 103 N83-17647
- NARASIMHAN, M. C.**
Research on application of Arc-Plasma Spraying (APS) [DE82-015220] p 70 N83-20408
- NAUMOV, S. F.**
An improved portable thermoradiometer /TRM/ for measuring the relative emissivity of solids at room temperature p 39 A83-20959
- NAZAROFF, W. W.**
Radon-daughter exposures in energy-efficient buildings [DE82-003711] p 9 N83-16964
- NEAL, R.**
Federal applications for wind energy systems. A subcontract report [DE83-000306] p 31 N83-21543
- NEAL, R. W.**
Assessment of distributed photovoltaic electric-power systems [DE83-900531] p 75 N83-21558
Assessment of distributed photovoltaic electric-power systems [DE83-900566] p 187 N83-22768
- NEALE, D.**
Solar thermionic energy converter experiment p 51 A83-27301
- NEAVE, K. G.**
Subsea permafrost in Harrison Bay, Alaska: An interpretation from seismic data [AD-A121020] p 125 N83-20479
- NEELY, M.**
Guide for the assessment of the availability of gasification-combined-cycle power plants [DE82-901905] p 77 N83-21579
- NEEMAN, E.**
Efficient daylighting in thermally controlled environments [DE82-003045] p 6 N83-16885
- NEILSON, D. L.**
Geothermal potential of Ascension Island, south Atlantic Phase 1 Preliminary examination [DE83-004066] p 132 N83-21523
- NELSON, C. H.**
Energy from biomass Land analysis and evaluation of supply models [DE83-003333] p 132 N83-21524
- NELSON, H. G.**
Corrosion of 310 stainless steel in H₂-H₂O-H₂S gas mixtures: Studies at constant temperature and fixed oxygen potential p 90 A83-20265
- NELSON, S. G.**
Development of standards and a cost model for coal agglomeration and related studies [DE82-011047] p 105 N83-17678
- NEPHEW, E. A.**
Performance and economics of 8 alternative systems for residential heating, cooling, and water heating in 115 US cities [DE83-003196] p 33 N83-21630
- NEPOMNIASHCHAI, E. V.**
The properties of fuel fractions obtained by the hydrogenation of Kansk-Achinsk coal p 94 A83-26920
- NERO, A. V.**
Radon-daughter exposures in energy-efficient buildings [DE82-003711] p 9 N83-16964
- NESNOW, S.**
Short-Term Bioassays in the Analysis of Complex Environmental Mixtures 2 [PB82-233172] p 23 N83-19420
- NEUBURGER, A.**
An approach to helicopter power selection p 3 A83-24828
- NEWSOME, J. F.**
Results of u-bend stress-corrosion-cracking specimen exposures in coal-liquefaction pilot plants [DE82-012889] p 105 N83-17708
Coal-liquefaction-plant fractionation-column corrosion-coupon studies [DE82-007469] p 139 N83-22360
- NG, D. J.**
Chemical characterization of organic contaminants in groundwater near an underground coal gasification site [DE82-004822] p 8 N83-16956
- NIBLETT, C.**
Ocean thermal-energy conversion p 152 A83-25125
- NICHOL, L. B.**
ASI/Pinson 1-kilowatt high-reliability wind system development Phase 1 Design and analysis [DE82-016128] p 180 N83-21602
- NICHOLS, B. E.**
Solar-photovoltaic power for broadcasting stations: An economic analysis [DE82-022498] p 55 N83-16873
- NICKOLS, J. W.**
Fractionation of an oil shale retort process water: Isolation of photoactive genotoxic components [DE82-010428] p 108 N83-18014
- NIELSEN, C. E.**
Salt gradient solar pond development [DE82-020630] p 58 N83-16916
- NIEMANN, R.**
OTEC plants for today's island market p 156 A83-27227

PERSONAL AUTHOR INDEX

- NIEVES, A. L.**
Commercial building design and energy conservation: A preliminary assessment [DE82-008581] p 17 N83-18067
- NIJS, J.**
High efficiency p+/+n-n/+ back-surface field silicon solar cells with very large short-circuit current densities p 41 A83-22913
Progress in photovoltaic energy conversion p 42 A83-23859
- NIKOLAENKO, I. U. E.**
The results of an experimental investigation of the effect of vibration loading parameters on the working characteristics of heat pipes p 184 A83-23924
- NIKULIN, I. U. M.**
An improved portable thermoradiometer /TRM/ for measuring the relative emissivity of solids at room temperature p 39 A83-20959
- NISCHIK, H.**
Redox ion flow cell for solar energy storage p 54 A83-29407
- NISHIKAWA, T.**
Electrophoretically deposited CdS and CdSe anodes for photoelectrochemical cells p 149 A83-19883
- NISHIURA, M.**
Amorphous silicon photovoltaic modules p 45 A83-26064
- NISONGER, R. J.**
Low power, air-cooled DC-Link aircraft generation systems p 159 A83-27324
- NIX, R. G.**
Reversible chemical reactions for energy storage in a large-scale heat utility p 51 A83-27315
- NIZAMI, A. A.**
Droplet size effects on NO_x/ formation in a one-dimensional monodisperse spray combustion system [ASME PAPER 82-JPGC-GT-10] p 93 A83-25268
- NOEL, G. T.**
Design and market study of photovoltaic systems for commercial building and applications Volume 3 Appendices [DE82-016729] p 70 N83-20397
- NOLL, R. B.**
ASI/Pinson 1-kilowatt high-reliability wind system development. Phase 1 Design and analysis [DE82-016128] p 180 N83-21602
- NORBERT, J.**
Application of energy dispersive X-ray fluorescence, ion sensitive electrodes and instrumental neutron activation in geochemical prospecting [BMFT-FB-T-82-152] p 111 N83-18123
- NORD, A. R.**
Modal testing of a rotating wind turbine [DE83-003630] p 178 N83-21526
Finite-element analysis and modal testing of a rotating wind turbine [DE83-002609] p 180 N83-21608
- NORING, J. E.**
Evaluation and application of solid thermal energy carriers in a high temperature solar central receiver system p 47 A83-27235
- NORMAN, J. H.**
Status report on sulfur iodine thermochemical water-splitting cycle [DE82-007164] p 88 N83-17633
- NORTHWOOD, D. O.**
Storing energy in metal hydrides - A review of the physical metallurgy p 188 A83-21562
- NORTON, J. F.**
Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States [DE82-011237] p 18 N83-18108
- NORTON, R. D.**
Use of hot-dry-rock geothermal resources for space heating: A case study [DE83-002947] p 135 N83-21636
- NOTIS, C.**
The useful potential of using existing data to uniquely identify predictable wind events and regimes, part 2 p 116 N83-19251
- NOUN, R. J.**
The acquisition of wind rights for wind energy development [DE82-009139] p 32 N83-21597
- NOVIKOV, V. M.**
Results of the investigation of the oil and gas deposits of Tadzhikistan on the basis of space photographs p 94 A83-26805
- NOVIL, M.**
Hydrogen use in a rural Alaskan community [DE83-000568] p 90 N83-22813
- NOYES, R. W.**
The sun, our star p 43 A83-24896

PERSONAL AUTHOR INDEX

- NSAKALA, N. Y.**
Effect of liquefaction processing conditions on combustion characteristics of solvent-refined coal
[DE82-903665] p 139 N83-22361
- NUERNBERGER, R.**
Technology of elevated voltage solar arrays Key items test and evaluation Part 2 Simulated LEO-plasma tests
[ESA-CR(P)-1646] p 73 N83-21513
- NUTTALL, L. J.**
Status of solid polymer electrolyte fuel cell technology and potential for transportation applications
p 154 A83-27186
- NYLAND, T. W.**
Operating experience with four 200 kW Mod-OA wind turbine generators
p 171 N83-19256

O

- OBEE, T. N.**
Evaluation of industrial advanced heat recovery/thermal energy storage systems
[DE82-906475] p 193 N83-16919
- OBERG, C. L.**
Partial liquefaction of coal by flash hydropyrolysis
[DE83-001145] p 126 N83-21077
- OBERMAYR, E.**
A highly efficient collector for small solar energy installations
[PB82-255191] p 60 N83-16948
- OBLOW, E. M.**
Evaluation of the mathematical and economic basis for conversion processes in the LEAP energy-economy model
[DE83-001706] p 167 N83-18079
- OBRIEN, G.**
Initial detailed designs for intermediate photovoltaic systems Branch bank
[DE82-005854] p 65 N83-19287
Analysis and design of residential load centers Volume 2 Appendices
[DE82-014253] p 24 N83-19956
Initial detailed designs for intermediate photovoltaic systems Warehouse
[DE82-014534] p 69 N83-20396
- OCALLAGHAN, J. E.**
Fuel-cell-propelled submarine-tanker-system study
[DE82-015149] p 183 N83-22827
- OCONNOR, K. F.**
Present and potential use of micro-hydroelectric schemes in remote locations
[DE82-904687] p 26 N83-20411
- OESCHGER, H.**
Uncertainties of predictions of future atmospheric CO₂ concentrations
p 2 A83-24251
- OFFENHARTZ, P. O.**
Use of inorganic materials for phosphorescent concentrating solar cells
[DE83-002860] p 83 N83-22799
- OFFERMAN, F. J.**
Residential air-to-air heat exchangers A study of the ventilation efficiencies of wall- or window-mounted units
[DE83-004752] p 33 N83-21617
- OFRY, E.**
The loss of power supply probability as a technique for designing stand-alone solar electrical (photovoltaic) systems
p 54 A83-29896
- OGDEN, W. H.**
Programmatic environmental overview Biomass fuels program
[DE82-906065] p 101 N83-16975
- OGIER, W. C.**
Exploratory study of coal conversion chemistry
[DE82-013414] p 138 N83-22354
- OHARA, F. M., JR.**
Sasol The commercial experience An executive summary
[DE82-011304] p 98 N83-16572
- OJHA, V. N.**
Al-Si peaked Schottky barriers
p 40 A83-22903
- OKADA, K.**
Sodium-sulfur battery program in Japan
p 189 A83-27175
- OKEEFE, D. R.**
Status report on sulfur iodine thermochemical water-splitting cycle
[DE82-007164] p 88 N83-17633
- OKINAKA, R. T.**
Fractionation of an oil shale retort process water Isolation of photoactive genotoxic components
[DE82-010428] p 108 N83-18014

- OLAVSON, L.**
A clean internal combustion engine for underground mining machinery A technical assessment and program plan, phase 1
[PB82-244724] p 89 N83-19104
- OLEOWNIK, A.**
Enlargement of the raw material basis of refineries by including hard coal Pilot plant for coal hydrogenation, construction phase
[BMFT-FB-1-82-192] p 126 N83-21054
- OLIVER, T. K.**
Energy from humid air
[DE82-017121] p 180 N83-21601
- OLMSTED, J., III**
Photochemical storage potential of azobenzenes
p 191 A83-28941
- OLSEN, K. B.**
Isolation of metallic complexes in shale oil and shale oil retort waters
[DE82-005931] p 98 N83-16835
- OLSEN, L. C.**
Experimental and theoretical studies of Cu₂O solar cells
p 40 A83-22907
- OLSON, D. A.**
Open-cycle systems performance analysis programming guide
[DE82-005696] p 174 N83-19282
- OLSON, D. E.**
Renewable energy system feasibility study
[AD-A121252] p 15 N83-18035
- OLSZEWSKI, M.**
Analysis of fixed-base flywheel systems for electric utility applications
p 190 A83-27310
- OLUIC, M.**
Tectonic elements registered on the Landsat imagery in area of Yugoslavia and their practical meaning
p 91 A83-21945
- ONEAL, D. L.**
Performance and economics of residential solar space heating
[DE83-003187] p 79 N83-21626
- ONEAL, H. P.**
Ethanol production in small- to medium-size facilities
[DE83-900875] p 146 N83-22807
- ONESTI, L. J.**
Alaskan coal Resources and developmental constraints
[DE83-000860] p 130 N83-21494
- OPPENHEIM, A. K.**
Rationale for advances in the technology of IC engines
[DE82-000264] p 14 N83-17886
A rationale for advances in the technology of IC engines
[DE82-005840] p 14 N83-17889
- ORANGE, A.**
High resolution seismic survey of the Hanna, Wyoming underground coal gasification area
[DE82-006887] p 112 N83-18137
- ORGAN, A. J.**
Back-to-back test for determining the pumping losses in a Stirling cycle machine
p 158 A83-27290
- OROURKE, J.**
Monitoring well systems in geothermal areas
[DE82-012770] p 133 N83-21586
- ORUDZHEVA, D. S.**
Remote-sensing studies of oil-and-gas-bearing terrones in the Caspian Basin
p 93 A83-25619
- OSTER, J., JR**
Automated installation methods for photovoltaic arrays
[DE83-004272] p 82 N83-22796
- OSWALD, R.**
An analysis of the cost/performance characteristics of passive solar materials and components
p 49 A83-27247
- OTTERSON, D. A.**
High performance liquid chromatographic hydrocarbon group-type analyses of mid-distillates employing fuel-derived fractions as standards
[NASA-TM-83072] p 120 N83-19920
- OWENS, E. C.**
Fuel property effects on diesel engine and gas turbine combustor performance
[AD-A120879] p 175 N83-20161
- OWENS, T. C.**
Effects of several disposable catalysts on liquefaction of lignite
[DE82-022188] p 138 N83-22351
- OWENS, W.**
Parametric analysis of closed cycle magnetohydrodynamic (MHD) power plants
[NASA-CR-165472] p 182 N83-22748

PATTERSON, D. J.

P

- PACKARD, K. R.**
Comparison of model and observations of the wake of a MOD-OA wind turbine
[DE83-002882] p 180 N83-21633
- PACKER, W. E.**
Parametric investigations and other related studies of energy storage type capacitors
[DE83-003426] p 197 N83-22785
- PAN, Y. C.**
MHD channel electrical boundary-layer theory and applications
p 151 A83-23131
- PAN, Y. S.**
Combustion of solvent-refined coal in a 100 HP firetube boiler
[DE82-007670] p 103 N83-17640
- PANCHAL, C.**
OTEC plants for today's island market
p 156 A83-27227
- PANGBORN, J. B.**
Status of the cadmium thermoelectrochemical hydrogen cycle
[DE83-900088] p 89 N83-22349
- PANOFISKY, H. A.**
Spectra over complex terrain in the surface layer
[DE83-000502] p 102 N83-17027
- PANTEL, K.**
Redox ion flow cell for solar energy storage
p 54 A83-29407
- PARAMONOV, B. M.**
On the orientation precision of satellite solar power stations
p 41 A83-23164
- PARDON, P., M.**
Main advances and needs on the study of geothermal resources in Chile by using remote sensing techniques
p 91 A83-21946
- PARK, G. L.**
Wind and turbine characteristics needed for integration of wind turbine arrays into a utility system
p 171 N83-19247
- PARKEN, W. H.**
Strategies for energy conservation in small office buildings
[PB82-245820] p 22 N83-19306
- PARKER, E. R.**
Low-alloy steels for thick-walled pressure vessels
[DE83-002547] p 128 N83-21127
- PARKER, J.**
Analysis and design of residential load centers Volume 2 Appendices
[DE82-014253] p 24 N83-19956
Design of a photovoltaic system for a southeast all-electric residence
[DE82-009349] p 69 N83-20394
- PARKER, J. H.**
Coal-waste artificial-reef program, phase 3 Volume 2 Comprehensive report
[DE82-005591] p 8 N83-16954
- PARKINSON, R.**
General aviation airplane fuel economy system model
p 20 N83-18647
- PARKS, V. J.**
Stress analysis of spherical mirror panels
[DE82-015656] p 77 N83-21585
- PARNAS, R. S.**
Dynamic simulation of Exxon's Catalytic Coal-Gasification process
[DE82-021973] p 146 N83-22823
- PARSONS, J. R.**
Use of parabolic trough collectors for residential/light commercial solar cooling systems
p 48 A83-27245
- PATEL, D. N.**
Assessment of phosphoric acid and trifluoromethane sulfonic acid fuel cells for vehicular powerplants
p 154 A83-27162
- PATEL, P.**
Evaluation of gasification and gas cleanup processes for use in molten carbonate fuel cell power plants
[DE83-003821] p 183 N83-22787
- PATEL, P. S.**
Coating applications for the molten carbonate fuel cell
p 153 A83-25538
- PATIL, M.**
Practical and theoretical analysis of continuous selection of temperature layers in a hot tank by an experimental tank and a simulation model
[BMFT-FB-T-82-171] p 13 N83-17842
- PATTEN, J.**
Parametric analysis of closed cycle magnetohydrodynamic (MHD) power plants
[NASA-CR-165472] p 182 N83-22748
- PATTERSON, D. J.**
Aviation Gasolines and Future Alternatives
[NASA-CP-2267] p 140 N83-22442

- Lightweight aircraft engines, the potential and problems for use of automotive fuels p 141 N83-22446
- PATTERSON, R. E.**
Cassegrainian concentrator solar array exploratory development module p 49 A83-27250
Development of technologies for welding interconnects to fifty-micron thick silicon solar cells [NASA-CR-170212] p 81 N83-22742
- PATTERSON, S.**
Cogeneration in Municipalities Proceedings from Workshops for Local Governments and Municipal Utilities [DE82-905758] p 6 N83-16921
- PATTI, N. C.**
Stratigraphic variations in oil-shale fracture properties [DE82-021088] p 136 N83-21702
- PATTON, J. B.**
Assessment of distributed solar power systems Issues and impacts [DE83-900640] p 78 N83-21618
- PAUCKERT, R. P.**
Design, fabrication, and initial testing of solar one receiver p 47 A83-27229
- PAULIN, M. O.**
Development of standards and a cost model for coal agglomeration and related studies [DE82-011047] p 105 N83-17678
- PAWLEWICZ, W. T.**
Optical properties of sputtered Si H [DE82-007072] p 62 N83-18491
- PEAK, M. J.**
Toxicology of coal gasification Chemical characterization p 148 N83-22960
- PEARCE, K. R.**
Emulsified fuel testing in a medium speed diesel engine [PB82-250697] p 98 N83-16564
- PEARSALL, N. M.**
Effect of grain boundaries on the minority carrier diffusion length in InP solar cells p 40 A83-22908
- PEASE, R. L.**
Electrical overstress failure in silicon solar cells [DE83-004475] p 80 N83-21637
- PEASLEE, A. T., JR.**
A data-gathering method for use in modeling energy research, development and demonstration programs [DE82-006153] p 16 N83-18040
- PEDERSEN, A. S.**
Magnesium for hydrogen storage p 88 A83-27339
- PEDERSEN, B.**
Residential air-to-air heat exchangers A study of the ventilation efficiencies of wall- or window-mounted units [DE83-004752] p 33 N83-21617
- PEDERSEN, P. S.**
Technical standards for fuel consumption in private automobiles [DE82-900748] p 106 N83-17735
- PEDERSON, R. J.**
Flow instability during direct steam generation in a line-focus solar-collector system [DE82-012887] p 70 N83-20404
- PEDERSON, S.**
Solar energy system performance evaluation Honeywell OTS 41, Shenandoah (Newman), Georgia [DE82-021004] p 73 N83-21521
Solar-energy-system performance evaluation Honeywell OTS 44, Ocmulgee, Georgia [NASA-CR-170031] p 74 N83-21530
- PELEG, I.**
Investigation of slurry fuel performance for use in a ramjet propulsor p 90 A83-21014
- PELLER, V. V.**
A method for producing heat pipes for cooling semiconductor photovoltaic cells and the heat pipe characteristics p 52 A83-28366
- PELROY, R. A.**
Identification and mutagenicity of nitrogen-containing polycyclic aromatic compounds in synthetic fuels [DE82-006173] p 106 N83-17739
- PERCIVAL, C. D.**
Solar electric technologies Methods of electric utility value analysis [DE82-014285] p 71 N83-20409
- PERCIVAL, D.**
Wind system value analysis for electric utilities A comparison of four methods [DE82-006963] p 164 N83-16883
Electric-utility value determination for wind energy Volume 2 A user's guide [DE82-010926] p 134 N83-21596
- PERCIVAL, W.**
Stirling engines for solar power generation in the 50 to 500 kW range p 50 A83-27274
- PERERS, B.**
Solar district heating with evacuated collectors: First year experience of the Knivsta plant [PB82-262114] p 59 N83-16939
- PEREZ-BLANCO, H.**
Steam ejector as an industrial heat pump [DE82-010184] p 14 N83-17847
Conceptual design and performance analysis of absorption heat pumps for waste-heat utilization [DE82-010202] p 186 N83-20060
- PERONE, S. P.**
Flash photoelectrochemical studies of transient electrode processes important in solar-energy conversion [DE83-003134] p 76 N83-21560
- PERRONE, E.**
Geothermal Energy: Tomorrow's Alternative Today A handbook for geothermal-energy development in Delaware [DE83-002987] p 35 N83-22782
- PERSHING, B. M.**
Potential fuel savings through improved airframe maintenance p 11 N83-17456
- PESSAGNO, S. L.**
Catalyst durability evaluation for advanced gas turbine engines [ASME PAPER 82-JPGC-GT-21] p 152 A83-25270
- PETERS, J. F.**
Demonstration of modification of a gasoline spark-ignited engine to permit using ethanol as a fuel [DE83-001384] p 114 N83-19101
- PETERS, W. A.**
Coal pyrolysis by hot solids from a fluidized-bed combustor [DE83-003344] p 117 N83-19829
Coal-gasification and tar-conversion reactions over calcium oxide [DE82-014635] p 139 N83-22358
- PETERSON, D. E.**
Reentry thermal testing of a general purpose heat source fueled clad [DE82-014125] p 184 N83-23146
Reentry thermal testing of light-weight radioisotope heater unit [DE82-014116] p 148 N83-23147
- PETERSON, G. N.**
Fuel/engine/airframe trade-off study Operational effects of increased freeze point fuels [AD-A121688] p 129 N83-21169
- PETERSON, J. E.**
Coalging polymer demonstration project [DE82-007019] p 105 N83-17726
- PETERSON, J. L.**
The application of DOE-2 in the predesign phase of commercial-building design [DE82-014067] p 31 N83-21201
- PETERSON, J. M.**
Peat-resource estimation in New York State [DE82-005156] p 108 N83-18007
- PETERSON, R. E.**
A geologic study of the Michigan Basin [PB83-136291] p 147 N83-22896
A geologic study of the Black Warrior Basin [PB83-136283] p 147 N83-22904
- PETRAKOVSKII, A. P.**
Higher level of utilization of fuel-energy resources [BLL-M-26855-(5825 4)] p 35 N83-22737
- PETRI, R. J.**
High-temperature composite latent/sensible heat storage [DE82-010396] p 62 N83-18063
- PETTIT, R. B.**
Simplified calculational procedure for determining the amount of intercepted sunlight in an imaging solar concentrator p 43 A83-23884
Variation in the microstructure of electrodeposited black chrome solar coatings [DE81-030842] p 56 N83-16878
- PETTY, S. E.**
Combustion of oil on water: An experimental program [DE82-014598] p 127 N83-21084
- PFANNER, H. G.**
The response of a 38m horizontal axis teetered rotor to yaw p 169 N83-19232
- PHILIPPE, C.**
Velocity measurements in an axisymmetric laminar flow using an optical technique of visualization in coherent light p 54 A83-29704
- PHILLION, D. W.**
Laser-plasma interaction experiments at laser wavelengths of 1.064 micron, 0.532 micron and 0.355 micron [DE82-013992] p 175 N83-20114
- PHUNG, D. L.**
Electric home heating Substitution for oil and gas [DE82-013762] p 133 N83-21581
- PIAZZA, T. R.**
The useful potential of using existing data to uniquely identify predictable wind events and regimes, part 1 p 116 N83-19250
- PIEKOSZEWSKI, J.**
Research on application of Arc-Plasma Spraying (APS) [DE82-015220] p 70 N83-20408
- PIELKE, R.**
Coastal zone wind energy. Part 3 A procedure to determine the wind power potential of the coastal zone [DE82-014334] p 134 N83-21598
- PIEM, S. J.**
Residential and commercial cogeneration systems assessment [PB82-240037] p 22 N83-19314
- PIERCE, E. T.**
Economic evaluation of solar energy systems in commercial buildings Methodology and case studies [PB82-260456] p 165 N83-16938
- PIGEAUD, A.**
Coating applications for the molten carbonate fuel cell p 153 A83-25538
- PILGUL, I. U. N.**
Results of the investigation of the oil and gas deposits of Tadzhikistan on the basis of space photographs p 94 A83-26805
- PINE, G. D.**
District heating and more-efficient buildings [DE81-025437] p 26 N83-20379
- PINKHAM, R. S.**
Sealed mini-nickel cadmium battery charging techniques, technical investigation report [AD-A119826] p 192 N83-16860
- PIRACES L., R.**
Main advances and needs on the study of geothermal resources in Chile by using remote sensing techniques p 91 A83-21946
Use of remote sensing techniques to study geothermal resources in and and semi-and zones in Chile p 92 A83-24577
- PITTMAN, P. F.**
Design and fabrication of a prototype system for photovoltaic residences in the Northeast [DE82-022210] p 55 N83-16872
- PLAETTNER, R. D.**
Amorphous silicon - A new semiconductor material for solar cells p 39 A83-21627
- PLUM, R.**
Development and implementation of dynamic methodologies for evaluating energy conservation strategies [PB82-240763] p 21 N83-19304
Development and implementation of dynamic methodologies for evaluating energy conservation strategies Executive summary [PB82-240771] p 21 N83-19305
- POETTGEN, H. G.**
Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 1 [BMFT-FB-T-82-151-VOL-1] p 15 N83-18026
Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 2 [BMFT-FB-T-82-151-VOL-2] p 15 N83-18027
- POLIKARPOV, G. G.**
Pressing problems of radioecology in light of solving atomic energy problems p 36 N83-22977
- POLLOCK, E. O.**
Comparative report. Performance of solar hot-water systems, 1980 - 1981 [DE83-000069] p 56 N83-16889
- PONNAPPAN, R.**
Performance of a cylindrical phase-change thermal energy storage unit p 191 A83-28969
- PONS, R. L.**
Preliminary test results for the small community solar power system [ASME PAPER 82-WA/SOL-30] p 44 A83-25687
- POOR, R. H.**
Experience and assessment of the DOE/NASA Mod-1 2000 kW wind turbine generator at Boone, North Carolina p 172 N83-19257
- POST, R. F.**
Physics of mirror systems [DE82-015908] p 176 N83-20770
- POTAPOV, N. I.**
An improved portable thermoradiometer /TRM/ for measuring the relative emissivity of solids at room temperature p 39 A83-20959
- POTTER, J. R.**
Feasibility of applications of microwave technology for nuclear power plant radioactive wastes [DE82-903143] p 29 N83-20744

- POWELL, J. R.**
Nuclear reactors using fine particulate fuel for primary power in space p 155 A83-27221
- HYFIRE** A Tokamak/high-temperature electrolysis system
[DE82-004806] p 88 N83-17323
- HYFIRE** A Tokamak/high-temperature electrolysis system
[DE82-013851] p 90 N83-23173
- POWELL, J. W.**
Economic evaluation of solar energy systems in commercial buildings Methodology and case studies [PB82-260456] p 165 N83-16938
- POWLES, S. R. J.**
The effects of tower shadow on the dynamics of a horizontal-axis wind turbine p 160 A83-27869
- PRATER, M. L.**
Geothermal resource assessment in Oklahoma [DE82-021288] p 100 N83-16874
- PRENGER, C.**
Artery heat pipes for space power systems p 185 A83-27128
- PRESSER, C.**
The use of slurry fuels in industrial furnaces [TAE-428] p 106 N83-17729
- PRICE, E. H.**
Air traffic control Its effect on fuel conservation p 12 N83-17464
- PRIMM, R. T., III**
Economic incentives for additional critical experimentation applicable to fuel dissolution [DE82-006818] p 106 N83-17737
- PRINS, V.**
Gasoline shortfall management p 148 N83-23213
- PROVOST, L. P.**
Evaluation of the maintenance effect on fugitive emissions from refineries in the south coast air quality management district [PB82-239260] p 23 N83-19356
- PRUETT, B.**
Laser-plasma interaction experiments at laser wavelengths of 1.064 micron, 0.532 micron and 0.355 micron [DE82-013992] p 175 N83-20114
- PRYOR, R. A.**
Design of antireflection coatings for textured silicon solar cells p 52 A83-27983
- PUCHALT, H.**
Application of energy dispersive X-ray fluorescence, ion sensitive electrodes and instrumental neutron activation in geochemical prospecting [BMFT-FB-T-82-152] p 111 N83-18123
- PURVIS, E. M., JR.**
Research, development and demonstration of an advanced actuated heat pump [PB82-254590] p 164 N83-16932
- PUTNAM, A.**
Combustion of oil on water An experimental program [DE82-014598] p 127 N83-21084
- R**
- RABER, E.**
Cleanup of groundwater contaminated by underground coal gasification [DE82-005824] p 19 N83-18118
- RACINE, W. C.**
Coordination of the onsite fuel cell program [PB83-119545] p 184 N83-22839
- RACKI, D.**
Automated installation methods for photovoltaic arrays [DE83-004272] p 82 N83-22796
- RADCHENKO, E. D.**
The properties of fuel fractions obtained by the hydrogenation of Kansk-Achinsk coal p 94 A83-26920
- RADKEY, R. L.**
Definition of cost-effective river-turbine designs [DE82-010972] p 175 N83-20413
- RADOSEVICH, L. G.**
Industry/Government Forum on Recent Policy and Budget Changes in the DOE Solar-Thermal Program [DE82-012511] p 36 N83-22801
- RAGHURAMAN, P.**
On insulation measurements using pyranometers and solar cell devices p 48 A83-27238
- Data report for the Northeast Residential Experiment Station, October 1981 [DE82-007648] p 61 N83-18044
- RAITHEL, W.**
Assessment of battery buses and battery technology [PB82-260019] p 11 N83-17428
- RALLIS, C. J.**
Further development of the fluidyne liquid-piston engine p 156 A83-27275
- RAMIREZ, A. L.**
A brief overview of geophysical probing technology [DE82-011217] p 19 N83-18133
- RAMSTHALER, J. H.**
Geothermal potential of Ascension Island, south Atlantic Phase 1 Preliminary examination [DE83-004066] p 132 N83-21523
- RAND, D. A. J.**
Nickel-zinc batteries [DE83-000208] p 197 N83-22770
- RANKEN, W. A.**
Design options for the SP-100 thermoelectric Nuclear Space Power Plant p 160 A83-27327
- RANKIN, J. G.**
Thermal control - Heat buses will operate like a public utility p 184 A83-24358
- RAO, D. B.**
Corrosion of 310 stainless steel in H₂-H₂O-H₂S gas mixtures Studies at constant temperature and fixed oxygen potential p 90 A83-20265
- RASIYAH, P.**
A mechanistic study of oxygen evolution on Li-doped Co₃O₄ p 85 A83-20586
- RASMUSSEN, N.**
Technical standards for fuel consumption in private automobiles [DE82-900748] p 106 N83-17735
- RAUH, R. D.**
Chemical bath deposition of thin film cadmium selenide for photoelectrochemical cells p 38 A83-20594
- Investigation of intercalated compounds for photoelectrochemical energy storage [DE83-000543] p 192 N83-16899
- RAULT, D.**
Radiative energy receiver for high performance energy conversion cycles p 46 A83-27138
- RAYMOND, R., JR.**
Relationship between pyrite formation and organic sulfur content of coal as revealed by electron microscopy [DE82-010417] p 104 N83-17652
- RAZGAITS, R.**
Advanced atmospheric fluidized-bed combustion design Ultrahigh velocity [DE83-004819] p 128 N83-21088
- RAZUMOVSKII, S. D.**
The kinetics and mechanism of the reaction of ozone with sulphides [BLL-OA-TRANS-1934-(6196 3)] p 94 N83-16411
- REAGAN, P.**
Thermionic technology infrastructure for space power p 159 A83-27298
- Thermionic converters for terrestrial applications p 159 A83-27299
- REDDOCH, T. W.**
Electric system impacts of storage heating and storage water heating, part 2 [DE81-032010] p 192 N83-16863
- A review of utility issues for the integration of wind electric generators p 173 N83-19269
- REDFIELD, A. E.**
Gulf coast ecological inventory user's guide and information base [DE83-900406] p 28 N83-20455
- REDMON, J. R.**
Electric system impacts of storage heating and storage water heating, part 2 [DE81-032010] p 192 N83-16863
- REED, R. M.**
Using peat for energy Potential environmental restraints Overview [DE82-005201] p 5 N83-16876
- REGIS, V.**
Evaluation of deterioration due to hot creep in chrome-molybdenum ferritic steels used in thermal power stations [BLL-CE-TRANS-7669-(9022 09)] p 162 N83-16470
- REICHMAN, B.**
Chalcogenophosphate photoelectrodes [NASA-CASE-LAR-12958-1] p 60 N83-18025
- REIDENBACH, V. G.**
Ethanol production in small- to medium-size facilities [DE83-900875] p 146 N83-22807
- REIFARTH, K.**
Enlargement of the raw material basis of refineries by including hard coal Pilot plant for coal hydrogenation, construction phase [BMFT-FB-I-82-192] p 126 N83-21054
- REIL, J.**
Heating of domestic water by waste heat recovery from household refrigerating equipment [BMFT-FB-T-82-156] p 7 N83-16930
- REILLY, C. A., JR.**
Toxicology of coal gasification Chemical characterization p 148 N83-22960
- REILLY, R. W.**
AQUASTOR - A computer model for cost analysis of aquifer thermal energy storage coupled with district heating or cooling systems p 191 A83-27314
- Cost of heat from a seasonal source [DE82-006026] p 194 N83-18045
- REINERT, K. A.**
Mathematical programming models for the economic design and assessment of wind energy conversion systems p 161 A83-27870
- REINKENHOF, J.**
Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field [DFVLR-FB-82-27] p 73 N83-21515
- REISFELD, R.**
The uranyl ion, fluorescent and fluorone-like - A review p 45 A83-26061
- REITER, E. R.**
The effects of atmospheric variability on energy utilization and conservation [DE83-003612] p 31 N83-21525
- REITZ, R. A.**
Catalytic coal gasification An emerging technology for SNG [DE82-007596] p 104 N83-17676
- REMICK, R. J.**
Status of the cadmium thermoelectrochemical hydrogen cycle [DE83-900088] p 89 N83-22349
- RENICK, S.**
Review and evaluation of automotive fuel conservation technologies [PB83-101139] p 30 N83-20844
- RENNE, D. S.**
Candidate wind-turbine-generator site summarized meteorological data for the period December 1976 through December 1981 [DE83-000884] p 102 N83-17028
- Assessing the representativeness of wind data for wind turbine site evaluation p 116 N83-19239
- Meteorological field measurements at potential and actual wind-turbine sites [DE83-001493] p 174 N83-19398
- REPPLIER, F. N.**
Geothermal resource assessment of Idaho Springs, Colorado Resource series 16 [DE83-000345] p 110 N83-18073
- RESTALL, J. E.**
High temperature erosion and erosion-hot corrosion of superalloys and coatings p 91 A83-21458
- RETELSDORF, H. J.**
Replacement of lumpy chrome ore by agglomerated ore concentrates and lowering of specific power consumption and improvement of Cr yield by means of improved slag composition in the production of HC ferrochrome [BMFT-FB-T-82-084] p 7 N83-16929
- REUTER, R. C., JR.**
Contact stresses on a thin plate after large displacements to a half parabolic surface [DE82-006998] p 63 N83-19136
- Effects of gaps in adhesives that bond elastically deformed panels to parabolic, cylindrical substructures [DE82-014720] p 72 N83-21154
- Deformation of a thin, elastic plate to a deep parabolic cylinder [DE82-012056] p 72 N83-21413
- REVERE, W.**
Configuration selection study for isolated loads p 41 A83-23137
- REVZAN, K. L.**
Residential air-to-air heat exchangers A study of the ventilation efficiencies of wall- or window-mounted units [DE83-004752] p 33 N83-21617
- REYNOLDS, J. R.**
Parametric investigations and other related studies of energy storage type capacitors [DE83-003426] p 197 N83-22785
- RICE, G.**
U K Consortium Stirling engine programme p 157 A83-27285
- RICHARDS, E. H.**
Solar furnace for flux gage calibration and thermal-effects testing [DE82-005769] p 62 N83-18062
- RICHARDSON, J. G.**
Design, construction, operation and costs of a modern small-scale fuel-alcohol plant [DE82-011019] p 107 N83-17754
- RICHARDSON, N. M.**
Propagation at 10 microns through smoke produced by atmospheric combustion of diesel fuel p 3 A83-26641
- RICHARDSON, S.**
Preliminary evaluation of environmental issues on the use of peat as an energy source [DE83-000820] p 34 N83-21651

RICHLEN, S. L.

Opportunities for direct-contact waste heat recuperators for industrial heat recovery [DE82-006280] p 15 N83-18038

RICHTER, G. N.

Enriched-air and oxygen gasification of Illinois No. 6 coal in a Texaco coal-gasification unit [DE82-903133] p 139 N83-22382

RICHTER, R.

Basic investigation into the electrical performance of solid electrolyte membranes [NASA-CR-169790] p 191 N83-16419

RICKERT, L. W.

Publications in life sciences synthetic fuels of Oak Ridge National Laboratory [DE83-001701] p 122 N83-19945

RICO, S. S.

Performance and operational analysis of a liquid desiccant open-flow solar collector p 49 A83-27246

RIGGLE, P.

Design of hydraulic output unit for 15 kW free-piston Stirling engine p 157 A83-27277
Development of a quiet Stirling cycle multi-fuel engine for electric power generation [AD-A121033] p 174 N83-19278

RINDT, J. R.

Effects of several disposable catalysts on liquefaction of lignite [DE82-022188] p 138 N83-22351

RINEHART, B. N.

Status of DOE small hydropower research and development projects [DE83-001353] p 125 N83-20434

RINGROSE, C. D.

Geothermal resource assessment of Idaho Springs, Colorado Resource series 16 [DE83-000345] p 110 N83-18073

RINKER, R. G.

Mass transfer and chemical reaction of gaseous species in non-catalytic and catalytic porous media supporting catalytic and non-catalytic liquids [DE82-021713] p 95 N83-16427

RIOS, M., JR.

Design, testing, and economics of a 430 W sub p photovoltaic concentrator array for non grid-connected applications [DE82-014687] p 68 N83-20388

RIPPIN, D. W. T.

A system of hydrogen-powered vehicles with liquid organic hydrides p 68 A83-27340

RISING, B. W.

CaO interactions in the staged combustion of coal [DE82-010299] p 103 N83-17641

RITCHIE, D. W.

Photovoltaic advanced research and development program in the United States [DE83-000307] p 83 N83-22814

RITSCHL, M.

Fundamental research on Fischer-Tropsch synthesis [BMFT-FB-T-82-020] p 125 N83-21052

RIX, D. H.

Design and experiences with a laboratory Stirling cycle machine p 157 A83-27284

ROACH, F.

Energy optimization in DOD facilities [DE82-008108] p 7 N83-16925

ROBERTS, P. B.

Role of water in energy development [DE82-011986] p 35 N83-22800

ROBERTS, P. B.

Centaur gas-turbine modification and development for solar-fossil hybrid operation [DE83-900192] p 177 N83-21366

ROBERTS, W. B.

Turbine engine fuel conservation by fan and compressor profile control p 12 N83-17467

ROBERTS, W. E.

Solar energy systems Standards for screening plastic containment materials [PB82-242454] p 62 N83-18921

ROBERTS, R. J.

Outdoor exposure tests of solar absorptive coatings [PB83-124560] p 84 N83-22840

ROBERTUS, R. J.

Methanol synthesis gas from catalytic steam reforming of wood [DE82-006082] p 106 N83-17734

ROBINSON, L. R.

Catalyst behavior in biomass gasification [DE82-006164] p 110 N83-18057

ROBINSON, L. R.

Catalytic gasification of biomass [DE82-005877] p 110 N83-18058

ROBINO, C. V.

Thermal degradation of solar collector surfaces p 44 A83-25535

ROCK, A.

Biostatistics and health impacts of energy technologies p 36 N83-22962

ROCKEY, D. E.

Comparison of evolving photovoltaic and nuclear power systems for earth orbital applications p 45 A83-27131

ROESSLER, B.

Research on application of Arc-Plasma Spraying (APS) [DE82-015220] p 70 N83-20408

ROESSLER, P.

Photobiology task of the advanced solar energy research program [DE82-012310] p 71 N83-20417

ROFER-DEPOORTER, C. K.

Catalytic coal conversion support Use of laser flash-pyrolysis for structural analysis [DE82-014124] p 139 N83-22366

ROGERS, M. L.

Tritium transport and control in the FED [DE82-002592] p 168 N83-18511

ROGERS, R. C.

Using a global hydrogen-air combustion model in turbulent reacting flow calculations p 86 A83-24687

ROGERS, W.

Turbine engine fuel conservation by fan and compressor profile control p 12 N83-17467

ROHATGI, N. T.

Gas characterization from fluidized-bed coal gasification [DE82-012396] p 138 N83-22357

ROHY, D. A.

Metal hydride heat pump p 3 A83-27211

ROLFE, E.

Fourth ESTEC spacecraft power-conditioning seminar [ESA-SP-186] p 176 N83-21006

ROMASHOV, A. A.

Remote-sensing studies of oil-and-gas-bearing terrones in the Caspian Basin p 93 A83-25619

ROOS, A.

Properties of oxidized copper surfaces for solar applications I p 54 A83-29512

ROSA, R. J.

Properties of oxidized copper surfaces for solar applications II p 54 A83-29513

ROSE, M. B.

Characteristics of a closed Brayton cycle piston engine p 151 A83-23135

ROSE, M. B.

Operational experience on the MP-200 series commercial wind turbine generators p 172 N83-19259

ROSENBERG, L. S.

An overview of the Goldstone Energy Systems study p 24 N83-19780

ROSENBERG, R.

The MCA method, a flight test technique to determine the thrust of jet aircraft in flight p 1 A83-19661

ROSENBROCK, H. H.

Proposal for a new design of wind power generator p 161 A83-27871

ROSENOVIST, K.

Stirling engines for solar power generation in the 50 to 500 kW range p 50 A83-27274

ROSOFF, D.

Commercial building design and energy conservation A preliminary assessment [DE82-008581] p 17 N83-18067

ROSOI, E., JR.

International energy indicators [DE82-012504] p 26 N83-20405

ROSS, D. S.

Exploratory study of coal conversion chemistry [DE82-013414] p 138 N83-22354

ROSS, P. N., JR.

Evaluation of tetrafluoroethane-1,2-disulfonic acid as a fuel cell electrolyte p 161 A83-28300

ROSS, R. G., JR.

Prospects for the development of non-noble metal catalysts for hydrogen-air fuel cells [DE82-013875] p 176 N83-20422

ROSS, R. G., JR.

Photovoltaic array Power conditioner interface characteristics [NASA-CR-169919] p 64 N83-19225

ROSSMEISSL, N. P.

Further development and evaluation of coal-water mixture technology [DE82-010518] p 106 N83-17736

ROTARIU, G. J.

Western oil shale development A technology assessment. Volume 8 Health effects of oil shale development [DE82-008695] p 109 N83-18015

ROTH, R.

Design and standardization of meteorological measurements for wind energy converting systems [BMFT-FB-T-82-168] p 168 N83-18172

ROTTMANN, D.

Oxygen supply for coal gasification power stations (combined cycle process) [BMFT-FB-T-82-018] p 131 N83-21505

ROTTY, R. M.

Exponential growth and atmospheric carbon dioxide p 2 A83-24255

ROUGE, J. D.

Distribution of and changes in industrial carbon dioxide production p 2 A83-24256

ROUGE, J. D.

Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States [DE82-011237] p 18 N83-18108

ROUSSEAU, J.

Solar/gas Brayton/Rankine cycle heat pump assessment [PB83-102319] p 67 N83-19963

ROWE, D. S.

Analytical modeling of a hydraulically-compensated compressed-air energy-storage system [DE83-005708] p 197 N83-21640

ROY, C. B.

Photoelectrochemical behaviour of electrodeposited and pressure-sintered Bi₂S₃, Bi₂S₃-PbS and Bi₂S₃-Ag₂S semiconductor electrodes p 40 A83-22905

RUBIN, C. B.

The comprehensive community energy management program. An evaluation [DE82-011552] p 17 N83-18060

RUBIO, F.

Reactive sputtered Ta₂O₅ antireflection coatings p 52 A83-27984

RUDDY, B.

SNG from land-based biomass 1981 program [PB83-10467] p 125 N83-20440

RUEGG, R. T.

Economic evaluation of solar energy systems in commercial buildings Methodology and case studies [PB82-260456] p 165 N83-16938

RUGGLES, A. E.

Open-cycle vapor compression heat pump [PB82-262569] p 8 N83-16947

RUHM, C. J.

Energy supply and demand in the Caribbean region, 1978-2000 [DE83-002312] p 18 N83-18080

RUMIANTSEV, V. D.

A method for producing heat pipes for cooling semiconductor photovoltaic cells and the heat pipe characteristics p 52 A83-28366

RUNYAN, J.

Artery heat pipes for space power systems p 185 A83-27128

RUPERT, V. C.

Laser-plasma interaction experiments at laser wavelengths of 1 064 micron, 0 532 micron and 0 355 micron [DE82-013992] p 175 N83-20114

RUSCETTA, C. A.

Geothermal Direct Heat Program Roundup, volume 1 [DE82-019912] p 135 N83-21628

RUSSELL, D. F.

A microprocessor-controlled photovoltaic-array loading unit [DE83-000797] p 75 N83-21556

RUSSELL, J. A.

Refining studies and engine testing of alternative highway-transportation fuels Identification and evaluation of optimized alternative fuels [DE83-003332] p 129 N83-21172

RUSSELL, M. C.

On insolation measurements using pyranometers and solar cell devices p 48 A83-27238

RUSSELL, T.

Data report for the Northeast Residential Experiment Station, October 1981 [DE82-007648] p 61 N83-18044

RUSSELL, T.

Research on application of Arc-Plasma Spraying (APS) [DE82-015220] p 70 N83-20408

RUTH, L. A.

Synthetic fuel effects in continuous combustion systems An experimental study of fuel nitrogen conversion in jet-stirred combustions [DE82-002686] p 103 N83-17646

RUTHERFORD, J. P.

Converting small industrial boilers to burn wood fuels [PB83-128116] p 147 N83-22844

RYAN, T. W., III

Refining studies and engine testing of alternative highway-transportation fuels Identification and evaluation of optimized alternative fuels [DE83-003332] p 129 N83-21172

RYBAK, S. C.

Description of the 3 MW SWT-3 wind turbine at San Geronimo Pass, California p 172 N83-19258

RYON, A. D.

Metal recovery from eastern oil shale
[DE82-004052] p 109 N83-18016

S

SAFI, M.

The effect of the melt heat treatment time on the properties of lithium lubricants with additives
p 94 A83-26921

SAITO, A.

Transient characteristics of flat-plate solar collector
p 42 A83-23333

SAKAI, H.

Amorphous silicon photovoltaic modules
p 45 A83-26064

SAKATA, I.

Origin of the difference in the open circuit voltage between p-n type and n-p type hydrogenated amorphous silicon solar cells
p 37 A83-19991

SAKUTA, K.

Development of solar total energy system for industrial sectors
p 48 A83-27244

SALISBURY, J. D.

Roadway-powered electric-vehicle project
[DE83-003147] p 184 N83-23243

SALLES, Y.

Industrial technology for economic and viable encapsulation for large solar panels
[PB82-259839] p 59 N83-16936

SALMON, R.

Energy optimization in DOD facilities
[DE82-008108] p 7 N83-16925

SALZANO, F.

Current research in advanced water electrolysis in the United States and abroad
p 87 A83-27216

SAMMELLS, A. F.

Status of the cadmium thermoelectrochemical hydrogen cycle
[DE83-900088] p 69 N83-22349

SANDHOLTZ, W. A.

Oil shale project run summary small retort run S-7
[DE82-004731] p 99 N83-16837

SANDHU, S. S.

Short-Term Bioassays in the Analysis of Complex Environmental Mixtures 2
[PB82-233172] p 23 N83-19420

SANDROCK, G.

A clean internal combustion engine for underground mining machinery A technical assessment and program plan, phase 1
[PB82-244724] p 69 N83-19104

SANDUSKY, W. F.

Candidate wind-turbine-generator site summarized meteorological data for the period December 1976 through December 1981
[DE83-000884] p 102 N83-17028

Meteorological field measurements at potential and actual wind-turbine sites
[DE83-001493] p 174 N83-19398

SANFORD, R. J.

Stress analysis of spherical mirror panels
[DE82-015656] p 77 N83-21585

SANSREGRET, J.

Light transport in planar luminescent solar concentrators - The role of DCM self-absorption
p 39 A83-22619

SARLES, R. L.

Converting small industrial boilers to burn wood fuels
[PB83-128116] p 147 N83-22844

SARV, H.

Droplet size effects on NO_x/ formation in a one-dimensional monodisperse spray combustion system
[ASME PAPER 82-JPGC-GT-10] p 93 A83-25268

SATHER, N.

OTEC plants for today's island market
p 156 A83-27227

SAUM, G. H.

Mine personnel locator and mine activity controller
[PB82-235979] p 200 N83-19315

SAUNDERS, A. L.

Operating experience with four 200 kW Mod-0A wind turbine generators
p 171 N83-19256

SAV, G. T.

Economic evaluation of solar energy systems in commercial buildings Methodology and case studies
[PB82-260456] p 165 N83-16938

SAWATA, S.

Development of solar total energy system for industrial sectors
p 48 A83-27244

SAXENA, S. C.

Review of hot-gas-desulfurization simulation models
[DE82-016265] p 138 N83-22356

SCAHILL, J.

Entrained flow, ablative fast pyrolysis of biomass
[DE82-005791] p 113 N83-18875

SCANLAN, T. F.

Investigation of attic-insulation effectiveness using actual energy-consumption data
[DE82-006822] p 17 N83-18055

Investigation of attic insulation effectiveness using actual energy consumption data
[DE83-000225] p 36 N83-22828

SCANTLAND, D. A.

The utilization of emergent aquatic plants for biomass-energy-systems development
[DE82-009174] p 124 N83-20395

SCHAEFFER, R.

Design of a photovoltaic system for a southeast all-electric residence
[DE82-009349] p 69 N83-20394

SCHAEZTLE, W. J.

Increasing summer peak power with aquifer storage
p 191 A83-27313

Aquifer thermal-energy-storage modeling
[DE83-900672] p 197 N83-22784

SCHALEGER, L. L.

Direct liquefaction of biomass Results from operation of continuous bench scale unit in liquefaction of water slumes of Douglas fir wood
[DE82-015703] p 124 N83-20414

SCHEFER, R. W.

Laser fluorescence measurements of the OH concentration in a combustion boundary layer
p 86 A83-24367

SCHEFFEE, R. S.

Further development and evaluation of coal-water mixture technology
[DE82-010518] p 106 N83-17736

SCHELLING, G. T.

Ethanol production in small- to medium-size facilities
[DE83-900875] p 146 N83-22807

SCHELP, H.

Future of alternate fuels for turbine engines
p 141 N83-22453

SCHENKER, M.

Estimating pollutant exposures from coal fired power plants in a rural region
[DE82-008136] p 19 N83-18109

SCHIFF, D.

An overview of large wind turbine tests by electric utilities
p 172 N83-19265

SCHIFFERS, U.

Power plant concepts using new coal conversion technologies
[BMFT-FB-T-82-031] p 131 N83-21506

SCHIFFMAN, Y. M.

National implications of high solar and biomass energy growth A technology assessment of solar energy systems
The TASE Project
[DE83-004935] p 34 N83-21638

SCHISSEL, P.

Stability of reflectors with polymenc coatings
[DE82-007774] p 60 N83-17723

SCHLADITZ, H.

Development of gas-phase metallized plaques for electrodes of storage batteries, in particular for nickel oxide electrodes
[PB82-255431] p 193 N83-16950

SCHMEDESHAGEN, B.

Pre-feasibility study for construction of a commercial coal hydrogenation plant
[BMFT-FB-T-82-190] p 109 N83-18034

SCHMIDT, D. P.

Linear oil displacement by the emulsion entrapment process
[DE82-007751] p 99 N83-16841

SCHMIDT, M.

The influence of large-scale advection on the vertical distribution of stratospheric source gases in 44 degree and 41 degree north
p 1 A83-20224

SCHMITT, W. R.

Manne power - Accomplishments of the 1970s
p 155 A83-27223

SCHNELLER, D.

A highly efficient collector for small solar energy installations
[PB82-255191] p 60 N83-16948

SCHNUR, F.

Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels
[PB82-255167] p 96 N83-16459

SCHOENER, A.

Effects of petroleum on selected uniform substrates
A feasibility study
[PB82-255084] p 10 N83-16985

SCHOENPFLUG, E.

Oxygen supply for coal gasification power stations (combined cycle process)
[BMFT-FB-T-82-018] p 131 N83-21505

SCHORNHORST, J. R.

The MOD-0A 200 kilowatt wind turbine generator design and analysis report
[NASA-CR-165127] p 163 N83-16859

SCHREDDER, J. M.

Comparison of advanced thermal and electrical storage for parabolic dish solar thermal power systems
p 47 A83-27232

SCHREIBEIS, R. L.

Federal applications for wind energy systems A subcontract report
[DE83-000306] p 31 N83-21543

SCHROEDER, J.

Investigation and development of systems for the storage of thermal energy in the temperature range from -25 deg C to +150 deg C
[PB82-255258] p 193 N83-16949

SCHROEDER, M.

F-chart method applied to large-scale solar collector systems subject to a shadow effect of adjacent collectors
p 37 A83-20136

SCHUCH, G.

The MCA method, a flight test technique to determine the thrust of jet aircraft in flight
p 1 A83-19661

SCHULMAN, I.

Comparison of evolving photovoltaic and nuclear power systems for earth orbital applications
p 45 A83-27131

SCHULTZ, D. F.

Critical research and advanced technology (CRT) support project
[NASA-TM-83019] p 123 N83-20361

SCHULTZ, J.

Photobiology task of the advanced solar energy research program
[DE82-012310] p 71 N83-20417

SCHWARTZ, M. B.

Computerized engine and airplane performance monitoring programs
p 12 N83-17465

SCHWARZ, R.

Review and evaluation of automotive fuel conservation technologies
[PB83-101139] p 30 N83-20844

SCHWEITZER, J. K.

18 1 pressure ratio axial/centrifugal compressor demonstration program
p 161 A83-29013

SCHWEIZER, T. C.

Assessment of distributed solar power systems Issues and impacts
[DE83-900640] p 78 N83-21618

SCHWENDEMAN, M. L.

Evaluation of the maintenance effect on fugitive emissions from refineries in the south coast air quality management district
[PB82-239260] p 23 N83-19356

SCOTT-MONCK, J.

Space solar cell technology development - A perspective
p 49 A83-27255

SCOTT, D. H.

Effect of manganese additions on the performance of aluminum air-battery anode alloys
[DE83-002277] p 196 N83-21629

SCOTT, D. S.

A systems analysis comparing conventional and hydrogen powered rail locomotives
p 87 A83-27213

SCOTT, J. H.

Perspective on our energy options
[DE82-005828] p 36 N83-22802

SCOTT, K.

Porous perovskite electrode as molten carbonate cathode
p 150 A83-20596

SEABAUGH, P. W.

Mass balance results for the Princeton 1 underground coal gasification field test
[DE82-005667] p 162 N83-16556

SEALOCK, L. J., JR.

Methanol synthesis gas from catalytic steam reforming of wood
[DE82-006082] p 106 N83-17734

Catalyst behavior in biomass gasification
[DE82-006164] p 110 N83-18057

Catalytic gasification of biomass
[DE82-005877] p 110 N83-18058

SEELY, D. B.

Initial utility experience with cluster of three Mod-2 wind turbine systems
p 173 N83-19268

SEFER, N. R.

Refining studies and engine testing of alternative highway-transportation fuels Identification and evaluation of optimized alternative fuels
[DE83-003332] p 129 N83-21172

- SEGURA, A.**
Photoconductivity and photovoltaic effect in indium selenide p 39 A83-22337
- SEHGAL, H. K.**
High temperature degradation in cobalt oxide selective absorber p 53 A83-28942
- SEIBERT, M.**
Photobiology task of the advanced solar energy research program [DE82-012310] p 71 N83-20417
- SEIDL, M.**
Desulphurisation of solid fuels in power stations by superconductive magnets [BLL-CE-TRANS-7855-(9022 09)] p 125 N83-21051
- SEILER, J. F.**
Outdoor exposure tests of solar absorptive coatings [PB83-124560] p 84 N83-22840
- SELF, S. A.**
Measurement of plasma conductivity using Faraday rotation of submillimeter waves p 151 A83-23139
- SELKOWITZ, S.**
Efficient daylighting in thermally controlled environments [DE82-003045] p 6 N83-16885
- SELLMANN, P. V.**
Subsea permafrost in Harrison Bay, Alaska. An interpretation from seismic data [AD-A121020] p 125 N83-20479
- SEMENA, M. G.**
The results of an experimental investigation of the effect of vibration loading parameters on the working characteristics of heat pipes p 184 A83-23924
- SEMINARA, J. L.**
A study of bolting problems, tools, and practices in the nuclear industry [DE82-902203] p 168 N83-19099
- SEMLER, T. T.**
Opportunities for direct-contact waste heat recuperators for industrial heat recovery [DE82-006280] p 15 N83-18038
- SENFLE, J. T.**
Relationships between coal constitution, thermoplastic properties and liquefaction behavior of coals and vitrinite concentrates from the lower Kittanning seam, part 1 [DE82-01248] p 118 N83-19860
- SENG, G. T.**
High performance liquid chromatographic hydrocarbon group-type analyses of mid-distillates employing fuel-derived fractions as standards [NASA-TM-83072] p 120 N83-19920
- SERAPHIN, B. O.**
Chemically vapor-deposited black molybdenum films of high IR reflectance and significant solar absorptance p 44 A83-25534
- SGAMBOTI, C. T.**
Evaluation of industrial advanced heat recovery/thermal energy storage systems [DE82-906475] p 193 N83-16919
- SGAMBOTI, C. T.**
Ceramic heat-exchanger applications study [DE83-003166] p 132 N83-21529
- SGILEVSKII, V. A.**
A system of criteria for evaluating the energy efficiency of an engine at the state of technical proposals p 1 A83-23437
- SHACKSON, R. H.**
Maintaining automotive mobility: Using fuel economy and synthetic fuels to compete with OPEC oil [DE83-004873] p 37 N83-23245
- SHAFER, T. B.**
Low-temperature pyrolysis of coal to produce diesel-fuel blends [DE83-001637] p 126 N83-21076
- SHAHAF, M.**
Flames with impinging jets p 91 A83-21423
- SHALTENS, R. K.**
Operating experience with four 200 kW Mod-0A wind turbine generators p 171 N83-19256
- SHALTENS, R. K.**
Experience and assessment of the DOE/NASA Mod-1 2000 kW wind turbine generator at Boone, North Carolina p 172 N83-19257
- SHAMMA, S. E.**
MHD channel electrical boundary-layer theory and applications p 151 A83-23131
- SHANE, M. K.**
Geothermal potential of Ascension Island, south Atlantic. Phase 1 Preliminary examination [DE83-004066] p 132 N83-21523
- SHANNON, D. W.**
Real time sensors in geothermal fluids, their costs and benefits [DE82-014857] p 130 N83-21328
- SHANNON, S. S., JR.**
Geothermal investigations in West Virginia [DE83-004480] p 136 N83-21703
- SHARMA, K. K.**
Al-Si peaked Schottky barriers p 40 A83-22903
- SHARP, J.**
Advanced solar/gas desiccant cooling system [PB82-243833] p 62 N83-18968
- SHARP, J. K.**
Game-theory approach to consumer incentives for solar energy [DE82-004501] p 56 N83-16882
- SHARP, R. D.**
The implications of a stochastic approach to air-quality regulations [DE83-001636] p 9 N83-16972
- SHATOKHINA, E. I.**
The kinetics and mechanism of the reaction of ozone with sulphides [BLL-OA-TRANS-1934-(6196 3)] p 94 N83-16411
- SHEAFFER, J. D.**
The effects of atmospheric variability on energy utilization and conservation [DE83-003612] p 31 N83-21525
- SHEIBLEY, D.**
Evaluation of production version of the NASA improved inorganic-organic separator [NASA-TM-83018] p 166 N83-18022
- SHEIBLEY, D. W.**
Cross-linked polyvinyl alcohol films as alkaline battery separators p 149 A83-20576
- SHEIH, M.**
Leachate-treatment technique utilizing fly ash as low-cost sorbent [DE82-010501] p 111 N83-18101
- SHELTON, E. M.**
Trends in motor gasolines, 1942 - 1981 [DE82-021124] p 96 N83-16550
- SHELTON, E. M.**
Motor gasolines, summer 1981 [DE82-014425] p 121 N83-19924
- SHEN, S. Y.**
Energy from biomass. Land analysis and evaluation of supply models [DE83-003333] p 132 N83-21524
- SHERMET, I. P.**
Study of psychophysiological distinctions of primates using delayed reaction test p 85 N83-26442
- SHERMAN, D. M.**
Transportation network models for energy supply analysis. Volume 1 Executive summary [DE82-903077] p 187 N83-20399
- SHERMAN, D. M.**
Transportation network models for energy supply analysis. Volume 3 Transportation network model user's guide and documentation [DE82-903079] p 187 N83-20400
- SHERWOOD, K. H.**
Design considerations in the use of Glauber salt for energy storage [DE82-019289] p 192 N83-16868
- SHESKIN, T. J.**
Performance degradation and cleaning of photovoltaic arrays p 48 A83-27236
- SHETTEL, D. L., JR.**
Uranium hydrogeochemical and stream sediment reconnaissance of the St. Michael NTMS quadrangle, Alaska [DE82-009999] p 99 N83-16844
- SHETTEL, D. L., JR.**
Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska [DE82-009666] p 115 N83-19196
- SHETTEL, D. L., JR.**
Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska [DE82-009664] p 115 N83-19197
- SHETTEL, D. L., JR.**
PLTSYM A FORTRAN computer system to plot Canadian symbol location maps for hydrogeochemical and stream-sediment reconnaissance data [DE83-000764] p 123 N83-20337
- SHIH, I.**
A semiconductor-insulator-semiconductor CdO-SiO₂-Si solar cell p 41 A83-22912
- SHIMAMOTO, G. T.**
National forecast for geothermal resource exploration and development with techniques for policy analysis and resource assessment [DE82-014641] p 133 N83-21588
- SHIMMIN, W. L.**
High power pulsed plasma MHD experiments [AD-A120526] p 176 N83-20781
- SHIMMIN, W. L.**
High power pulsed plasma MHD experiments [AD-A120526] p 176 N83-20782
- SHINGLETON, J. G.**
An analysis of the cost/performance characteristics of passive solar materials and components p 49 A83-27247
- SHIPUNOV, V. L.**
An improved portable thermoradiometer /TRM/ for measuring the relative emissivity of solids at room temperature p 39 A83-20959
- SHIRLEY, F. W.**
Advanced atmospheric fluidized-bed combustion design. Ultrahigh velocity [DE83-004819] p 128 N83-21088
- SHORT, M. G.**
Development of a Stirling engine rod seal p 158 A83-27294
- SHU, H. T.**
Flow distribution control characteristics in manne gas turbine waste-heat recovery system. Phase 2 Flow distribution control in waste-heat steam generators [AD-A119310] p 175 N83-20054
- SHUKLA, S. N.**
Transient analysis of a natural circulation solar water heater with a heat exchanger p 41 A83-23129
- SIBBETT, B. S.**
Geothermal potential of Ascension Island, south Atlantic. Phase 1 Preliminary examination [DE83-004066] p 132 N83-21523
- SICHERMAN, A.**
Decision framework for technology choice. Volume 1 A case study of one utility's coal-nuclear choice [DE82-902213] p 113 N83-18554
- SIDNELL, N. A.**
Parametric investigations and other related studies of energy storage type capacitors [DE83-003426] p 197 N83-22785
- SIEGEL, H. M.**
Review and evaluation of automotive fuel conservation technologies [PB83-101139] p 30 N83-20844
- SIEMSEN, G.**
Redox ion flow cell for solar energy storage p 54 A83-29407
- SIMBURGER, E. J.**
Load following impacts of a large wind farm on an interconnected electric utility system p 151 A83-22675
- SIMON, J. A.**
The Illinois State Geological Survey. The next quarter century p 112 N83-18139
- SIMON, M.**
Large parabolic dish collectors with small gas-turbine, Stirling engine or photovoltaic power conversion systems p 160 A83-27329
- SIMON, R. L.**
Potential errors in using one anemometer to characterize the wind power over an entire rotor disk p 171 N83-19254
- SIMONS, G.**
Hot-gas cleanup for molten-carbonate fuel cells [DE82-002500] p 163 N83-16864
- SIMPSON, D. S.**
Fleet experience using a methanol/unleaded gasoline blend [DE83-003834] p 129 N83-21171
- SIMPSON, W. F., JR.**
Energygrams. Brief descriptions of energy technology [DE82-003278] p 199 N83-16891
- SIMPSON, W. F., JR.**
Energygrams. Brief descriptions of energy technology [DE82-003277] p 199 N83-16892
- SIMPSON, W. F., JR.**
Energygrams. Brief descriptions of energy technology [DE83-001668] p 35 N83-22792
- SINGAL, C. M.**
Open-circuit voltages across two junctions in n/+/-p-p/+ solar cells under high illumination levels p 51 A83-27976
- SINGER, M. J.**
Regional thermal and electric energy output of salt-gradient solar ponds in the U S [ASME PAPER 82-WA/SOL-27] p 44 A83-25689
- SINGH, R. V.**
Open-circuit voltages across two junctions in n/+/-p-p/+ solar cells under high illumination levels p 51 A83-27976
- SINGH, S. N.**
Diffusion length determination in n/+/-p-p/+ structure based silicon solar cells from the intensity dependence of the short-circuit current for illumination from the p/+/- side p 52 A83-27982
- SINNETT, C.**
Fuel quality/processing study. Volume 3 Fuel upgrading studies [NASA-CR-165326-VOL-3] p 144 N83-22754
- SISSINE, F.**
Energy-efficient technology. Advancing US competitiveness and productivity [GPO-98-637] p 25 N83-20371
- SIVAPALAN, S.**
Augmentation of power in slow-running vertical-axis wind rotors using multiple vanes p 160 A83-27868
- SIVASEGARAM, S.**
Premixed, turbulent combustion of a sudden-expansion flow p 92 A83-23748
- SIVASEGARAM, S.**
Augmentation of power in slow-running vertical-axis wind rotors using multiple vanes p 160 A83-27868

- SKELTON, J. C.**
Biomass cogeneration A business assessment
[DE82-011773] p 101 N83-16928
- SKOK, A. J.**
Coating applications for the molten carbonate fuel cell
p 153 A83-25538
- SKOLNIK, E. G.**
Further development and evaluation of coal-water mixture technology
[DE82-010518] p 106 N83-17736
- SKORPIK, J. R.**
Design of highwall mining equipment electronic guidance package
[DE82-006115] p 108 N83-18005
- SLIFER, L. W., JR.**
Comparative values of advanced space solar cells
[NASA-TM-84951] p 60 N83-18023
- SLOCUM, D. R.**
A model for the collection of minority carriers generated in the depletion region of a Schottky barrier solar cell
p 40 A83-22910
- SLONSKI, M.**
A survey of manufacturers of solar thermal energy systems
[NASA-CR-169924] p 63 N83-19223
- SMELTZER, E. E.**
Gas characterization from fluidized-bed coal gasification
[DE82-012396] p 138 N83-22357
- SMITH, C. F.**
Geotoxic materials in the surface environment
[DE82-005855] p 23 N83-19333
- SMITH, D. L.**
Polycrystalline solar cell/substrate growth by integrated vacuum evaporation
[DE82-017203] p 58 N83-16917
- SMITH, F. H.**
Cleanup of groundwater contaminated by underground coal gasification
[DE82-005824] p 19 N83-18118
- SMITH, I. E.**
Investigation of the geothermal potential of the UK The Southampton (Western Esplanade) geothermal well A preliminary assessment of the resource
p 109 N83-18029
- SMITH, J. E.**
Gulf coast ecological inventory user's guide and information base
[DE83-900406] p 28 N83-20455
- SMITH, L. D.**
Solar array switching power management
p 45 A83-27132
- SMITH, L. R.**
Characterization of exhaust emissions from methanol- and gasoline-fueled automobiles
[PB83-116830] p 149 N83-23249
- SMITH, M. R.**
National forecast for geothermal resource exploration and development with techniques for policy analysis and resource assessment
[DE82-014641] p 133 N83-21588
- SMITH, P. J.**
Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 2 User's manual for a computer program for 1-dimensional coal combustion or gasification (1-DICOG)
[DE82-015610] p 119 N83-19868
- SMITH, P. J.**
Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 3 User's manual for a computer program for 2-Dimensional Coal Gasification or Combustion (PCGC-2)
[DE82-015611] p 119 N83-19869
- SMITH, R. B.**
Stored chemical energy propulsion system for underwater applications
[AIAA PAPER 81-1601] p 188 A83-23132
- SMITH, S. W.**
The equilibrium constant for the reversible reaction $H_2S + 3H_2O + /L0\ 66K0\ 34/2\ CO_3$ yields $4H_2 + CO_2 + /L0\ 66K0\ 34/2\ SO_4$ at elevated temperature
p 150 A83-20590
- SMITH, T. J.**
Industry's assessment of the number of airplanes in the general aviation fleet along with their hours flown and fuel consumption data powered by what type of engines, when and for what reasons, through the year 2000
p 140 N83-22445
- SMOLIK, G. R.**
Effect of simulated medium-Btu coal gasifier atmospheres on the biaxial stress rupture behavior of four candidate coal gasifier alloys
[DE82-008607] p 104 N83-17661
- SMOOT, J. D.**
Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 2 User's manual for a computer program for 1-dimensional coal combustion or gasification (1-DICOG)
[DE82-015610] p 119 N83-19868
- SMOOT, L. D.**
Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 3 User's manual for a computer program for 2-Dimensional Coal Gasification or Combustion (PCGC-2)
[DE82-015611] p 119 N83-19869
- SMOOT, L. D.**
Basic combustion and pollutant-formation processes for pulverized fuels
[DE82-013773] p 29 N83-20457
- SMOOT, L. D.**
Combustion research needs
[PB83-107813] p 128 N83-21091
- SNEDDEN, R. B.**
Test report on the combustion of PERC and LBL wood oils
[DE82-004485] p 95 N83-16429
- SNEDDEN, R. B.**
Combustion of solvent-refined coal in a 100 HP firetube boiler
[DE82-007670] p 103 N83-17640
- SNOW, G. C.**
Catalyst durability evaluation for advanced gas turbine engines
[ASME PAPER 82-JPGC-GT-21] p 152 A83-25270
- SNOW, J. W.**
Coastal zone wind energy Part 3 A procedure to determine the wind power potential of the coastal zone
[DE82-014334] p 134 N83-21598
- SNUGGERUD, D.**
Abuse resistant high rate lithium/thionyl chloride cells
p 154 A83-27180
- SNYMAN, J. A.**
Numerical determination of the configuration of a rotating blade with constant stress
p 150 A83-22020
- SODHA, M. S.**
Transient analysis of a natural circulation solar water heater with a heat exchanger
p 41 A83-23129
- SOFIAKIS, N. F.**
Study of psychophysiological distinctions of primates using delayed reaction test
p 85 N83-26442
- SOLLO, C.**
Distribution voltage for high-power satellites
p 153 A83-27150
- SOLMAN, F. J.**
Performance of an experimental photovoltaic-powered house
[DE82-000662] p 58 N83-16908
- SOLOMON, J. A.**
Analysis of environmental issues related to small-scale hydroelectric development 6 Dissolved oxygen concentrations below operating dams
[DE82-007127] p 22 N83-19329
- SONNICHSEN, J. C.**
Assessment of the need for dry cooling, 1981 update
[DE82-008395] p 146 N83-22803
- SOPORI, B. L.**
Design of antireflection coatings for textured silicon solar cells
p 52 A83-27983
- SORENSEN, C. M.**
Diffusion flame studies of the chemical and physical mechanisms of soot formation from aromatic and substituted aromatic fuels
[DE82-009310] p 120 N83-19879
- SOUKUP, R. J.**
A model for the collection of minority carriers generated in the depletion region of a Schottky barrier solar cell
p 40 A83-22910
- SOWELL, R.**
Variation in the microstructure of electrodeposited black chrome solar coatings
[DE81-030842] p 56 N83-16878
- SPALL, W. D.**
Fractionation of an oil shale retort process water Isolation of photoactive genotoxic components
[DE82-010428] p 108 N83-18014
- SPARROW, E. M.**
Fundamental heat-transfer processes related to phase-change thermal-storage media
[DE83-002205] p 196 N83-21639
- SPARROW, F. T.**
Energy Conservation in Historic Structures An information/awareness bulletin
[DE82-005212] p 6 N83-16903
- SPEARS, J. W.**
Comparative report. Performance of solar hot-water systems, 1980 - 1981
[DE83-000069] p 56 N83-16889
- SPEARS, J. W.**
Rymark 1, Rymark 2, and Rymark 3, Frederick, Maryland Solar-energy-system performance evaluation, May 1981 through March 1982
[DE83-000067] p 57 N83-16890
- SPECTOR, I. C.**
Liquid-phase methanol process development unit Installation, operation, and support studies
[DE82-012725] p 121 N83-19940
- SPEIDEL, K.**
A highly efficient collector for small solar energy installations
[PB82-255191] p 60 N83-16948
- SPEIZER, F.**
Estimating pollutant exposures from coal fired power plants in a rural region
[DE82-008136] p 19 N83-18109
- SPENCER, R.**
Advanced photovoltaic-trough development
[DE82-015646] p 77 N83-21584
- SPERA, D. A.**
Performance and load data from Mod-0A and Mod-1 wind turbine generators
p 171 N83-19255
- SPIELBERG, N.**
Applications of ion beam technology
[NASA-CR-169797] p 88 N83-16493
- SPIRO, C. L.**
Catalytic effects of alkali metal salts in the gasification of coal char
[DE82-000850] p 103 N83-17645
- SPOGEN, L. R.**
Roadway-powered electric-vehicle impact study analysis of selected utility-service areas
[DE83-003143] p 180 N83-22030
- SPOGEN, L. R., JR.**
Fuel-cell technology assessment Volume 2 Evaluation of Japan
[DE83-004146] p 182 N83-22771
- SPOGEN, L. R., JR.**
Fuel-cell technology assessment Volume 3 Evaluation of Tunisia
[DE83-004294] p 182 N83-22772
- SPOGEN, L. R., JR.**
Fuel-cell technology assessment Volume 5 Evaluation of South Korea
[DE83-004299] p 182 N83-22773
- SPOGEN, L. R., JR.**
Fuel-cell technology assessment Volume 4 Evaluation of Taiwan
[DE83-004160] p 183 N83-22810
- SPOGEN, L. R., JR.**
Fuel-cell technology assessment Volume 1 The potential value of US fuel-cell technology in foreign countries
[DE83-004372] p 183 N83-22820
- SPURK, J. H.**
Experimental investigation of shock initiated methane-combustion near a wall
p 93 A83-26200
- SQUIRES, T. G.**
Fossil-energy
[DE83-003817] p 124 N83-20383
- SRINIVASAN, K.**
The use of mechanical energy storage in an unconventional, rough terrain vehicle
p 190 A83-27309
- SRINIVASAN, S.**
The structure of the double layer at the mercury-phosphoric acid interface from studies of adsorption of thiourea and its implications on oxygen reduction kinetics
p 149 A83-19876
- SRINIVASAN, S.**
Acid fuel cell technologies for vehicular power plants
p 154 A83-27185
- SRINIVASAN, V.**
An isothermal second-order Ringbom-Stirling engine computer program
p 157 A83-27281
- SRIVASTAVA, G. P.**
Al-Si peaked Schottky barriers
p 40 A83-22903
- STAHL, J.**
Instrumental methods of analysis of sulfur compounds in synfuel process streams
[DE82-011559] p 95 N83-16446
- STAHL, W.**
Exploration deliberations
p 144 N83-22762
- STAMOUDIS, V. C.**
Toxicology of coal gasification Chemical characterization
p 148 N83-22960
- STANIUNAS, J. W.**
On-site fuel cell field test support program
[PB83-121723] p 28 N83-20439
- STAPFER, G.**
Thermoelectric conversion for space nuclear power
p 155 A83-27222
- STARKE, U.**
Flue gas desulfurization with waste water evaporation Phase 2 Observation of the experiments at Weiher II [BMFT-FB-T-82-026] p 125 N83-21053
- STARLING, K. E.**
Development of a thermodynamic properties correlation framework for the coal conversion industry, phase 2
[DE82-009866] p 148 N83-23190
- STARNER, S. H.**
Joint measurements of radial velocity and scalars in a turbulent diffusion flame
p 86 A83-24355

- STARZYNSKI, J. S.**
Reentry thermal testing of light-weight radioisotope heater unit
[DE82-014116] p 148 N83-23147
- STASEK, G.**
Technology of elevated voltage solar arrays Key items test and evaluation Part 2 Simulated LEO-plasma tests
[ESA-CR(P)-1646] p 73 N83-21513
- STAVNES, S. A.**
Assessment of the geothermal resources of Kansas
[DE83-003234] p 145 N83-22790
- STAVROU, J.**
Energy from biomass Land analysis and evaluation of supply models
[DE83-003333] p 132 N83-21524
- STEELE, J. L.**
Heat flow and geothermal potential of Kansas
[DE83-003235] p 134 N83-21609
- STEEPLES, D. W.**
Assessment of the geothermal resources of Kansas
[DE83-003234] p 145 N83-22790
- STEFANAKOS, E. K.**
Renewable energy system feasibility study
[AD-A121252] p 15 N83-18035
- STEINBERG, B. A.**
A systems analysis comparing conventional and hydrogen powered rail locomotives p 87 A83-27213
- STEINBERG, M.**
Flash pyrolysis of biomass with reactive and non-reactive gases
[DE83-001850] p 137 N83-22336
- STEINER, D.**
Investigation of latent heat storage materials in the medium and high temperature range
[PB82-259896] p 193 N83-16933
- STEINHARDT, E.**
Stability and response characteristics of one- and two-blade wind turbines
[DGLR PAPER 82-084] p 152 A83-24196
- STEINVALL, O.**
Laser depth sounding for locating oil below water surface A preliminary survey
[FOA-C-30290-E1] p 98 N83-16753
- STELLA, P. M.**
U.S. welding technology - Constraints to space implementation p 49 A83-27249
- STENGER, F. J.**
Tests of an alternating current propulsion subsystem for electric vehicles on a road load simulator
[NASA-TM-83036] p 182 N83-22749
- STEPHANEDES, Y. J.**
Development and implementation of dynamic methodologies for evaluating energy conservation strategies
[PB82-240763] p 21 N83-19304
- STEPHANEDES, Y. J.**
Development and implementation of dynamic methodologies for evaluating energy conservation strategies Executive summary
[PB82-240771] p 21 N83-19305
- STEPHEY, H. M.**
Ultrasonically enhanced size reduction of coal
[DE82-008679] p 113 N83-18416
- STERMAN, J. D.**
The energy transition and the macroeconomy A framework for policy analysis
[DE82-007839] p 16 N83-18039
- STERN, G.**
High-temperature molten salt solar thermal systems p 51 A83-27317
- STERRETT, R.**
Monitoring well systems in geothermal areas
[DE82-012770] p 133 N83-21586
- STEVENS, H.**
OTEC plants for today's island market p 156 A83-27227
- STEWART, W. F.**
The effect of parasitic refrigeration on the efficiency of magnetic liquefiers p 155 A83-27212
- STOELTZING, R.**
Automated installation methods for photovoltaic arrays
[DE83-004272] p 82 N83-22796
- STOLTE, W. J.**
Photovoltaic subsystem optimization and design tradeoff study
[DE82-013393] p 69 N83-20392
- STONE, G.**
Spectra over complex terrain in the surface layer
[DE83-000502] p 102 N83-17027
- STONE, J. L.**
Amorphous silicon bibliography update - Introduction p 41 A83-22915
- STONE, J. L.**
Photovoltaic advanced research and development program in the United States
[DE83-000307] p 83 N83-22814
- STOVALL, J. P.**
Electric system impacts of storage heating and storage water heating, part 2
[DE81-032010] p 192 N83-16863
- STOWERS, I. F.**
Energy and Technology Review p 164 N83-16922
- STRAKEY, J. P.**
Formation/decomposition of condensable hydrocarbons during the gasification of coal
[DE82-014493] p 119 N83-19866
- STRAND, R.**
Cartographic evaluation of environmental-management strategies
[DE82-009828] p 35 N83-22702
- STRAND, R. H.**
Environmetrics of synfuels Part 4 Project Results Tracking System (PRTS)
[DE82-011444] p 10 N83-16977
- STRASSER, G.**
New priorities in energy-conservation research and development
[DE82-005988] p 16 N83-18054
- STRASZHEIM, W. E.**
Fossil-energy
[DE83-003817] p 124 N83-20383
- STRATZ, F.**
Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels
[PB82-255167] p 96 N83-16459
- STREHLOW, R. A.**
Flame acceleration mechanisms under conditions of partial confinement
[PB83-109884] p 120 N83-19881
- STRNISTE, G. F.**
Fractionation of an oil shale retort process water Isolation of photoactive genotoxic components
[DE82-010428] p 108 N83-18014
- STROHSCHNEIN, H.**
Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 1
[BMFT-FB-T-82-151-VOL-1] p 15 N83-18026
- STROHSCHNEIN, H.**
Utilization of industrial waste heat, citing an integrated iron and steel works as an example to save primary energy and to reduce the burden on the environment, volume 2
[BMFT-FB-T-82-151-VOL-2] p 15 N83-18027
- STUCKAS, K. J.**
The spark-ignition aircraft piston engine of the future p 141 N83-22450
- STUERMER, D. H.**
Chemical characterization of organic contaminants in groundwater near an underground coal gasification site
[DE82-004822] p 8 N83-16956
- SUBRAMANIAN, K.**
Solar residential total energy system using the sodium heat engine - A concept study p 47 A83-27231
- SUENAGA, M.**
Metallurgical aspects of interstrand resistance
[DE82-005504] p 186 N83-17342
- SUHRBIE, K. M.**
Toxicology of coal gasification Chemical characterization p 148 N83-22960
- SULLIVAN, P.**
An analysis of the cost/performance characteristics of passive solar materials and components p 49 A83-27247
- SULLIVAN, R. L.**
Wind system value analysis for electric utilities A comparison of four methods
[DE82-006963] p 164 N83-16883
- SULLIVAN, T. J.**
Energy efficient engine Fan test hardware detailed design report
[NASA-CR-165148] p 4 N83-16341
- SULLIVAN, T. L.**
Structural fatigue test results for large wind turbine blade sections p 170 N83-19246
- SUREK, T.**
Influence of grain boundaries on solar cell performance
[DE82-004662] p 56 N83-16881
- SUREK, T.**
Photovoltaic advanced research and development program in the United States p 83 N83-22814
- SUREK, T.**
Advanced silicon-sheet-growth techniques
[DE82-017088] p 84 N83-22831
- SURETTE, R. G.**
Design, fabrication, and initial testing of solar one receiver p 47 A83-27229
- SURPRENANT, J.**
Abuse resistant high rate lithium/thionyl chloride cells p 154 A83-27180
- SUTHERLAND, R. J.**
Penetration for four solar technologies in electric utilities and the environmental benefits
[DE82-010864] p 59 N83-16927
- SUTHERLAND, R. J.**
Penetration and air-emission-reduction benefits of solar technologies in the electric utilities
[DE82-002637] p 9 N83-16971
- SUTTON, P. L.**
An assessment of the multifuel capability and alternative fuel potential of the automotive Stirling engine /ASE/
p 156 A83-27273
- SVENSSON, S.**
Laser depth sounding for locating oil below water surface A preliminary survey
[FOA-C-30290-E1] p 98 N83-16753
- SWALLOW, D. W.**
MHD channel performance for potential early commercial MHD power plants p 151 A83-23134
- SWANBERG, C.**
Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703
- SWEENEY, J. L.**
World oil
[DE82-906440] p 27 N83-20433
- SWEET, J. N.**
Variation in the microstructure of electrodeposited black chrome solar coatings
[DE81-030842] p 56 N83-16878
- SWEET, L. M.**
General aviation airplane fuel economy system model p 20 N83-18647
- SWEETEN, J. M.**
Ethanol production in small- to medium-size facilities
[DE83-900875] p 146 N83-22807
- SWETINICK, M. A.**
The non-Federal oceanographic community An overview
[NASA-CR-169802] p 102 N83-17414
- SWIFT, A. H. P.**
The investigation of passive blade cyclic pitch variation using an automatic yaw control system
[DE83-000651] p 178 N83-21548
- SWORDER, D. D.**
Regulation of a system with variable structure p 43 A83-24761
- SZACHNOWSKI, W.**
Association-solvation characteristic of fuels and lubricating and hydraulic oils
[NASA-TM-76957] p 96 N83-16525
- SZEDON, J. R.**
Development of copper sulfide/cadmium sulfide thin-film solar cells
[DE83-001421] p 74 N83-21539

T

- TACINA, R. R.**
Catalytic combustion with steam injection
[ASME PAPER 82-JPGC-GT-23] p 93 A83-25271
- TADAISHI, Y.**
Study on composite flywheels for energy storage p 188 A83-22701
- TAKAHASHI, S.**
A study on the hydrogen-oxygen diffusion flame in high speed flow p 93 A83-26199
- TALLMADGE, G. E.**
Review of Thawtron device for thawing frozen coal
[DE82-903145] p 123 N83-20330
- TAMAKI, H.**
R and D of energy saving and new energy utilization in Japanese manne engineering p 4 A83-27225
- TANAKA, T.**
Development of solar total energy system for industrial sectors p 48 A83-27244
- TANI, T.**
Development of solar total energy system for industrial sectors p 48 A83-27244
- TARPLEY, W. B., JR.**
Ultrasonically enhanced size reduction of coal
[DE82-008679] p 113 N83-18416
- TARRICONE, L.**
Effect of grain boundaries on the minority carrier diffusion length in InP solar cells p 40 A83-22908
- TATE, R. E.**
The Light Weight Radioisotope Heater Unit (LWRHU) A technical description of the reference design
[DE82-014121] p 148 N83-23138
- TAUBE, M.**
A system of hydrogen-powered vehicles with liquid organic hydrides p 88 A83-27340
- TAYLOR, F. G.**
Use of vegetation to ameliorate building microclimates An assessment of energy-conservation potentials
[DE82-013255] p 32 N83-21572

- TAYLOR, L. E.**
The useful potential of using existing data to uniquely identify predictable wind events and regimes, part 1
p 116 N83-19250
- TAYLOR, P. B.**
The iron and steel industry Energy consumption and conservation in the iron and steel industry
[ENERGY-AUDIT-SER-16] p 14 N83-18020
- TAYLOR, R. D.**
Energy-conserving and passive-solar construction details
[DE82-014467] p 76 N83-21569
- TAYLOR, S. R.**
Ultrasonically enhanced size reduction of coal
[DE82-008679] p 113 N83-18416
- TAYLOR, T., JR.**
The assessment of variable valve timing of internal combustion engines for fuel economy improvements and practicability
[PB82-265364] p 5 N83-16766
Review and evaluation of automotive fuel technologies Volume 1 Summary
[PB83-101147] p 30 N83-20845
- TEAGUE, H. L.**
Design of a vortex-flow solar chemical reactor
[DE83-000031] p 58 N83-16914
- TEARE, J. D.**
Design strategy for the combustion of coal-derived liquid fuels
[DE82-905496] p 95 N83-16444
- TEGGER, H.**
Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels
[PB82-255167] p 96 N83-16459
- TETZLAFF, G.**
Design and standardization of meteorological measurements for wind energy converting systems
[BMFT-FB-T-82-168] p 168 N83-18172
- TEW, R. C., JR.**
Computer program for Stirling engine performance calculations
[NASA-TM-82960] p 166 N83-17423
- THACKSTON, J.**
Monitoring well systems in geothermal areas
[DE82-012770] p 133 N83-21586
- THALLER, L. H.**
Design flexibility of redox flow systems
p 189 A83-27177
Pore size engineering applied to starved electrochemical cells and batteries
p 154 A83-27201
- THAN, K.**
Testing of heat exchanger systems for reheating flue gases from wet scrubbing desulfurization plants
[BMFT-FB-T-82-170] p 13 N83-17841
- THIEME, L. G.**
Improved Stirling engine performance using jet impingement
p 158 A83-27288
- THODE, H. C., JR.**
Model simplification to examine the interrelationships between coal, gas and oil use
[DE82-007816] p 110 N83-18061
- THOMAS, A.**
OTEC plants for today's island market
p 156 A83-27227
- THOMAS, M. A.**
An Energy Crisis Management Simulation for the State of California
[RAND/R-2899-CEC] p 25 N83-20363
- THOMAS, R. E.**
Study of battery accelerated-testing techniques
[DE82-017125] p 198 N83-22834
- THOMAS, W. R. L.**
Light transport in planar luminescent solar concentrators - The role of DCM self-absorption
p 39 A83-22619
- THOMASSEN, K. I.**
Fusion technology status and requirements
[DE82-010754] p 174 N83-19615
- THOMPSON, R. E.**
Cleanup of groundwater contaminated by underground coal gasification
[DE82-005824] p 19 N83-18118
- THOMS, R. L.**
Factors affecting storage of compressed air in solution mined salt cavities
p 191 A83-27311
Issues affecting storage of compressed air in solution-mined salt cavities
[DE83-002017] p 197 N83-22804
- THOMSON, W.**
Preliminary evaluation of environmental issues on the use of peat as an energy source
[DE83-000820] p 34 N83-21651
- THOREN, R.**
The importance of satisfactory positioning, diving and mapping systems, suitable for exploration and transportation in ice-covered sea areas
[FOA-B-60003-M7] p 107 N83-17999
- THRESHER, R. W.**
Large Horizontal-Axis Wind Turbines
[NASA-CP-2230] p 169 N83-19231
Atmospheric turbulence parameters for modeling wind turbine dynamics
p 171 N83-19252
- TIEN, H. T.**
Electrochemical solar cells using CdSe thin film electrodes
p 37 A83-19885
- TILT, G. R.**
Energy considerations Mobile homes in the south
[DE82-009586] p 17 N83-18068
- TIMNAT, Y. M.**
Investigation of slurry fuel performance for use in a ramjet propulsor
p 90 A83-21014
Flames with impinging jets
p 91 A83-21423
The use of slurry fuels in industrial furnaces
[TAE-428] p 106 N83-17729
- TIRSELL, G.**
Laser-plasma interaction experiments at laser wavelengths of 1.064 micron, 0.532 micron and 0.355 micron
[DE82-013992] p 175 N83-20114
- TIWARI, G. N.**
Transient analysis of a natural circulation solar water heater with a heat exchanger
p 41 A83-23129
- TOBEY, R. A.**
Potential biological hazards of nickel arsenides associated with retorting of oil shale Toxic effects of particulate NiAs₂
[DE82-010978] p 22 N83-19328
- TOBIAS, L.**
Assessment of phosphoric acid and trifluoromethane sulfonic acid fuel cells for vehicular powerplants
p 154 A83-27162
- TODD, J. A.**
Low-alloy steels for thick-walled pressure vessels
[DE83-002547] p 128 N83-21127
- TOEKES, B.**
Sperry low-temperature geothermal conversion system Volume 1 Organic-working-fluid properties
[DE82-018529] p 163 N83-16867
- TOGAMI, H.**
Design, testing, and economics of a 430 W sub p photovoltaic concentrator array for non grid-connected applications
[DE82-014687] p 68 N83-20388
- TOKUDA, S.**
R and D of energy saving and new energy utilization in Japanese marine engineering
p 4 A83-27225
- TOLLE, F. P.**
Fuel/engine/airframe trade-off study Operational effects of increased freeze point fuels
[AD-A121688] p 129 N83-21169
- TOREN, R.**
The importance of satisfactory positioning, diving and mapping systems suitable for exploration and transportation in ice-covered sea areas
[PB83-109587] p 123 N83-20342
- TORTORELLI, P. F.**
Thermal-convection-loop study of the corrosion of Fe-Ni-Cr alloys by molten NaNO₂/sub 3-KNO₃/sub 3
[DE83-004228] p 80 N83-22407
- TOSCANO, W. M.**
Design of hydraulic output Stirling engine
[NASA-CR-167976] p 181 N83-22739
- TOSTE, A. P.**
Isolation of metallic complexes in shale oil and shale oil retort waters
[DE82-005931] p 98 N83-16835
- TRAENKENSCHUH, H.**
Power plant concepts using new coal conversion technologies
[BMFT-FB-T-82-031] p 131 N83-21506
- TRAN, D. Q.**
Gasification of land-based biomass
[PB83-109918] p 122 N83-19946
- TRASK, D. C.**
The useful potential of using existing data to uniquely identify predictable wind events and regimes, part 1
p 116 N83-19250
- TRATTNER, R.**
Leachate-treatment technique utilizing fly ash as low-cost sorbent
[DE82-010501] p 111 N83-18101
- TREMEL, F. J.**
Toxicology of coal gasification Chemical characterization
p 148 N83-22960
- TREMOULET, O. L.**
Development of a quiet Stirling cycle multi-fuel engine for electric power generation
[AD-A121033] p 174 N83-19278
- TRENT, B. C.**
Stratigraphic variations in oil-shale fracture properties
[DE82-021088] p 136 N83-21702
- TRESTER, P. W.**
Status report on sulfur iodine thermochemical water-splitting cycle
[DE82-007164] p 88 N83-17633
- TRETTEL, D. W.**
The useful potential of using existing data to uniquely identify predictable wind events and regimes, part 1
p 116 N83-19250
- TRIMBLE, J.**
Analysis of energy use at US institutional buildings
[DE82-004670] p 6 N83-16886
- TRIPP, B. W.**
Petroleum contamination Quantification and passive tagging in organisms and sediments
[PB82-254087] p 113 N83-18880
- TROIANO, A. R.**
Localized corrosion in materials for geothermal power
[DE82-015608] p 128 N83-21136
- TROTTER, W. K.**
Progress of solar technology and potential farm uses
[PB83-100065] p 71 N83-20436
- TRUE, J. A.**
Alternative engine fuels Educational demonstration project
[DE83-004579] p 141 N83-22462
- TRUMBLE, T. M.**
Space applications of gallium arsenide solar cells
p 50 A83-27258
- TRUNCCELLITO, N.**
Design of a photovoltaic system for a southeast all-electric residence
[DE82-009349] p 69 N83-20394
- TRZASKA, T. J.**
Repetitive switching for inductive energy storage
[AD-A121029] p 194 N83-19277
- TSAI, G. J.**
Potential for domestic heat recovery
[DE82-901395] p 15 N83-18037
- TSEUNG, A. C. C.**
A mechanistic study of oxygen evolution on Li-doped Co3O4
p 85 A83-20586
- TSUBOMURA, H.**
Photoelectrolysis of water under visible light with doped SrTiO₃ electrodes
p 38 A83-20580
- TSUCHIO, T.**
Transient characteristics of flat-plate solar collector
p 42 A83-23333
- TSUDA, I.**
Development of solar total energy system for industrial sectors
p 48 A83-27244
- TSUIKI, M.**
Electrophoretically deposited CdS and CdSe anodes for photoelectrochemical cells
p 149 A83-19883
- TSUO, Y. S.**
Influence of grain boundaries on solar cell performance
[DE82-004662] p 56 N83-16881
- TSVETKOVA, K.**
Photoelectrochemical processes in bismuth germanium oxide, Bi₂GeO₂₀ single crystals
p 38 A83-20581
- TUCK, W. J.**
Rotary engines
p 152 A83-25140
- TULLY, G. F.**
Analysis and design of residential load centers Volume 2 Appendices
[DE82-014253] p 24 N83-19956
Design of a photovoltaic system for a southeast all-electric residence
[DE82-009349] p 69 N83-20394
- TURCHI, P. J.**
Research needs Prime-power for high energy space systems
[AD-A120209] p 163 N83-16861
- TURIEL, I.**
Energy and life-cycle cost analysis of a six-story office building
[DE82-004840] p 20 N83-18963
- TURNER, A. B.**
Gas characterization from fluidized-bed coal gasification
[DE82-012396] p 138 N83-22357
- TURNER, D. L.**
Geothermal energy resource assessment of parts of Alaska
[DE83-000140] p 116 N83-19299
- TURNER, F. B.**
Environmental effects of solar-thermal power systems Ecological observations during early testing of the Barstow 10-MWe pilot STPS
[DE83-004454] p 85 N83-22856

TURNER, R. E.

Laser-plasma interaction experiments at laser wavelengths of 1 064 micron, 0 532 micron and 0 355 micron
[DE82-013992] p 175 N83-20114

TUSCHER, E.

Porous metal hydride compacts - Preparation, properties and use p 88 A83-27338

U

UCHIDA, Y.

Amorphous silicon photovoltaic modules p 45 A83-26064

UENO, Y.

Electrophoretically deposited CdS and CdSe anodes for photoelectrochemical cells p 149 A83-19883

UHL, J. E.

Multiple-tracer gas analyzer [DE82-017032] p 120 N83-19876

UKEN, E. A.

Alternative motor fuels p 148 N83-23214

ULRICH, P. C.

Environmental quality research Fate of toxic jet fuel components in aquatic systems [AD-A122548] p 30 N83-21168

UNKEL, W.

Analytical investigation of axial field limitations in MHD generators p 151 A83-23126

URBAN, C. M.

Characterization of exhaust emissions from methanol- and gasoline-fueled automobiles [PB83-116830] p 149 N83-23249

URTIEW, P. A.

Recent flame-propagation experiments at LLNL within the liquefied gaseous-fuels spill-safety program [DE82-010729] p 103 N83-17651

USHER, J. L.

Nuclear reactors using fine particulate fuel for primary power in space p 155 A83-27221

UTAKA, Y.

Transient characteristics of flat-plate solar collector p 42 A83-23333

UVAROVA, E. M.

The effect of the melt heat treatment time on the properties of lithium lubricants with additives p 94 A83-26921

UYEHARA, O. A.

Fuel-composition and -vaporization effects on combustion-chamber deposits [DE82-012576] p 104 N83-17670

V

VACHON, W. A.

An overview of large wind turbine tests by electric utilities p 172 N83-19265

VALDEZ, J. G.

Potential biological hazards of nickel arsenides associated with retorting of oil shale Toxic effects of particulate Ni₅As₂ [DE82-010978] p 22 N83-19328

VALGORA, M.

Solar array switching power management p 45 A83-27132

VALLET, C. E.

Physical chemistry of molten-salt batteries Current-induced composition gradients in molten LiCl-KCl [DE83-001684] p 192 N83-16875

Electromigrational composition gradients in molten carbonates A review [DE83-002593] p 177 N83-21075

VAN MEERBERGEN, J.

High efficiency p+/n-n+/+ back-surface field silicon solar cells with very large short-circuit current densities p 41 A83-22913

VAN OVERSTRAETEN, R.

High efficiency p+/n-n+/+ back-surface field silicon solar cells with very large short-circuit current densities p 41 A83-22913
Progress in photovoltaic energy conversion p 42 A83-23859

VAN STRIJP, R. M.

Computer simulation of the optical behaviour of amorphous silicon solar cells p 51 A83-27979

VANBERGEN, E.

A study of possible detrimental effects on internal combustion engines by the combustion of gasohol blends [CSIR-ME-446] p 129 N83-21166

VANDEKERKOVE, L.

Optimization of pulling conditions by electronic bombardment of polycrystalline silicon ribbons for solar cells p 55 A83-29946

VANDERBORG, N. E.

Recovery of minerals from US coals [DE82-008173] p 108 N83-18010

VANDERLEEDEN, G. A.

Application of laser annealing and laser-induced diffusion to photovoltaic conversion [DE82-006792] p 61 N83-18056

VANKE, V. A.

On the choice of the optimal density of vibrators for a rectenna p 184 A83-23464

VANLINT, V. A. J.

Electrical overstress failure in silicon solar cells [DE83-004475] p 80 N83-21637

VANROYEN, G. L.

Bellingham Phase 3, Engineering and technology development for a hot-water district-heating system employing thermal-energy storage [DE82-000106] p 192 N83-16862

VARLIJEN, T. C.

HYFIRE A Tokamak/high-temperature electrolysis system [DE82-004806] p 88 N83-17323

HYFIRE A Tokamak/high-temperature electrolysis system [DE82-013851] p 90 N83-23173

VASCIAVEO, L.

Back-to-back test for determining the pumping losses in a Stirling cycle machine p 158 A83-27290

VAUDIN, M.

The structure of 110 tilt boundaries in large area solar silicon [NASA-CR-170204] p 81 N83-22744

VENERO, A.

Advanced solar/gas desiccant cooling system [PB82-243833] p 62 N83-18968

VENIER, C. G.

Fossil-energy [DE83-003817] p 124 N83-20383

VENTERS, D.

Toxicology of coal gasification Chemical characterization p 148 N83-22960

VERMEULEN, P. J.

Numerical determination of the configuration of a rotating blade with constant stress p 150 A83-22020

VERZINO, W. J., JR.

Catalytic coal conversion support. Use of laser flash-pyrolysis for structural analysis [DE82-014124] p 139 N83-22366

VETTER, O. J.

Reinjection and injection of fluids in geothermal operations (state of the art) p 135 N83-21632

VEZIROGLU, T. N.

Solar power applications - Alcohols p 39 A83-21066

Miami International Conference on Alternative Energy Sources, 5th, Miami Beach, FL, December 13-15, 1982, Proceedings of Condensed Papers p 3 A83-25575

VIELSTICH, W.

Fundamental research on Fischer-Tropsch synthesis [BMFT-FB-T-82-020] p 125 N83-21052

VIGEHOLM, B.

Magnesium for hydrogen storage p 88 A83-27339

VILLET, R.

Devising efficient biotechnological processes for the production of fuels and chemicals from biomass [DE82-017089] p 124 N83-20418

VINCE, I. M.

The origin and nature of 'prompt' nitric oxide in flames p 1 A83-22344

VINEYARD, T. A.

Performance and economics of residential solar space heating [DE83-003187] p 79 N83-21626

VINKE, A.

Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels [PB82-255167] p 96 N83-16459

VISWANATHAN, R.

Some 2 1/4Cr-1 Mo steels for coal-conversion pressure vessels [DE82-901349] p 105 N83-17707

VITERNA, L. A.

Fixed pitch rotor performance of large horizontal axis wind turbines p 169 N83-19233
Free yaw performance of the Mod-0 large horizontal axis 100 kW wind turbine p 170 N83-19235

VITTITOE, C. N.

Simplified calculational procedure for determining the amount of intercepted sunlight in an imaging solar concentrator p 43 A83-23884

VOECKS, G. E.

Combustion engine system [NASA-CASE-NPO-14565-2] p 89 N83-19826

VOLLAN, A.

Aeroelastic stability and dynamic response analysis of the LDB-125 vertical axis wind turbine [FFA-TN-1982-19] p 167 N83-18028

VONDEREMSE, J. F.

Low power, air-cooled DC-Link aircraft generation systems p 159 A83-27324

VONKLEINSMID, W. H.

Investigation of methanol as a boiler fuel for electric-power generation [DE82-905495] p 97 N83-16560

VOORHEES, L. D.

Using peat for energy Potential environmental restraints Overview [DE82-005201] p 5 N83-16876

VOROBEV, V. T.

Remote-sensing studies of oil-and-gas-bearing territories in the Caspian Basin p 93 A83-25619

VOYENTZIE, P.

Assessment of phosphoric acid and trifluoromethane sulfonic acid fuel cells for vehicular powerplants p 154 A83-27162

VRANOS, A.

Chemical effects in vaporizing synthetic fuels [DE82-003352] p 96 N83-16549

Experimental study of the thermal stability of hydrocarbon fuels [NASA-CR-168027] p 105 N83-17728

VRESK, J.

Reliability and design guidelines for combined solar-space-heating and domestic hot-water system [DE83-003341] p 79 N83-21635

VULLIET, W. V.

Electrical overstress failure in silicon solar cells [DE83-004475] p 80 N83-21637

VYAS, A.

Energy from biomass Land analysis and evaluation of supply models [DE83-003333] p 132 N83-21524

W

WADE, G. W.

Metal hydride heat pump p 3 A83-27211

WAGNER, C. K.

The utilization of emergent aquatic plants for biomass-energy-systems development [DE82-009174] p 124 N83-20395

WAGNER, F. T.

Prospects for the development of non-noble metal catalysts for hydrogen-air fuel cells [DE82-013875] p 176 N83-20422

WAGNER, O. C.

High-cycle-life, high-energy-density nickel-zinc batteries [DE82-012896] p 195 N83-20376

WAGNER, P.

Proceedings of the Workshop on Radioactivity Associated with Coal Gas [DE82-007880] p 18 N83-18100

WAGNER, S.

Stability and response characteristics of one- and two-blade wind turbines [DGLR PAPER 82-084] p 152 A83-24196

WAIBEL, R. T.

Multi-fuel low-NOx burner development, phase 2 [PB83-126292] p 147 N83-22845

WAKAMIYA, W.

Combustion of oil on water An experimental program [DE82-014598] p 127 N83-21084

WALDRON, K. J.

The use of mechanical energy storage in an unconventional, rough terrain vehicle p 190 A83-27309

WALKER, D.

Design and component testing of a low-temperature waste-heat-driven refrigeration system, phases 1 and 2 [DE82-014721] p 179 N83-21571

WALKER, G.

An isothermal second-order Ringbom-Stirling engine computer program p 157 A83-27281

WALKER, L.

Ocean thermal-energy conversion p 152 A83-25125

WALMSLEY, H. L.

The generation of electric currents by the turbulent flow of dielectric liquids I - Long pipes p 161 A83-29089

WALSH, F.

Fuel cell electrolyte for portable electrical generating equipment [AD-A121176] p 174 N83-19275

- WALSH, P. J.**
Health and safety issues of alternate energy systems [DE82-002918] p 9 N83-18959
The implications of a stochastic approach to air-quality regulations [DE83-001636] p 9 N83-18972
- WALTER, C. E.**
Route profile analysis to determine suitability of electric postal-delivery vehicles [DE82-012216] p 29 N83-20842
Roadway-powered electric-vehicle project [DE83-003147] p 184 N83-23243
- WALTERS, A.**
Preliminary evaluation of environmental issues on the use of peat as an energy source [DE83-000820] p 34 N83-21651
- WALTERS, R. E.**
Aerodynamic tests of Darrieus wind turbine blades p 151 A83-23128
- WALTZ, W. R.**
Economic incentives for additional critical experimentation applicable to fuel dissolution [DE82-006818] p 106 N83-17737
- WANG, T. C.**
Energy utilization of electric and hybrid vehicles p 188 A83-27164
- WANG, T. S.**
Study of net soot formation in hydrocarbon reforming for hydrogen fuel cells [DE83-001046] p 90 N83-22352
- WARCHOL, E. J.**
Initial utility experience with turbine of three Mod-2 wind turbine systems p 173 N83-19268
- WARNER, R. M., JR.**
An optimization of monolithic photovoltaic series arrays p 38 A83-20751
- WARNER, T. H.**
Photovoltaic 1-5 curve measurement techniques [DE83-000447] p 80 N83-22534
- WATANABE, T.**
50 kW Stirling engine p 157 A83-27282
- WATERS, M. D.**
Short-Term Bioassays in the Analysis of Complex Environmental Mixtures 2 [PB82-233172] p 23 N83-19420
- WATSON, A. P.**
Health and safety issues of alternate energy systems [DE82-002918] p 9 N83-18959
- WATSON, J. D.**
High power pulsed plasma MHD experiments [AD-A120526] p 176 N83-20781
High power pulsed plasma MHD experiments [AD-A120526] p 176 N83-20782
- WATSON, J. S.**
Modeling and evaluation of designs for solid hydrogen storage beds p 87 A83-27333
Metal recovery from eastern oil shale [DE82-004052] p 109 N83-18016
- WATSON, R. A.**
Finite-element analysis and modal testing of a rotating wind turbine [DE83-002609] p 180 N83-21608
- WATTS, A. W.**
WTS-4 system verification unit for wind/hydroelectric integration study p 173 N83-19267
- WAYLAND, J. R.**
Controlled source audio-magnetotelluric (CSMAT) resistivity measurements for in-situ combustion [DE82-016398] p 120 N83-19877
- WEAVER, P.**
Photobiology task of the advanced solar energy research program [DE82-012310] p 71 N83-20417
- WEAVER, R. D.**
Workshop on the Status of Industrial Organic Electrochemistry, summary [DE82-901982] p 103 N83-17647
- WEBER, C. L.**
Catalytic evaluation for H-coal [DE82-014457] p 138 N83-22355
- WEBER, S. L.**
Methanol synthesis gas from catalytic steam reforming of wood [DE82-006082] p 106 N83-17734
Catalyst behavior in biomass gasification [DE82-006164] p 110 N83-18057
Catalytic gasification of biomass [DE82-005877] p 110 N83-18058
- WEBER, W.**
Problem solution areas related to the implementation of the large wind turbine Voith WEC 520 [DGLR PAPER 82-083] p 152 A83-24195
- WEED, T.**
Devonian shale extraction test wells [DOE/MC-08386/T1] p 108 N83-18013
- WEGNER, M.**
Heating of domestic water by waste heat recovery from household refrigerating equipment [BMFT-FB-T-82-156] p 7 N83-16930
- WEHREY, M. C.**
Utility experience with two demonstration wind turbine generators p 173 N83-19266
- WEI, L. Y.**
Area utilization efficiency of a sloping heliostat system for solar concentration p 39 A83-22618
- WEINBERGER, B.**
Semiconducting polyacetylene materials for energy-conversion applications [DE82-012320] p 70 N83-20407
- WEINBERGER, S. M.**
Design study of a high power rotary transformer [NASA-CR-168012] p 186 N83-16630
- WEINGART, O.**
Low-cost composite blades for the Mod-0A wind turbines p 170 N83-19242
- WEINZIERL, P.**
Porous metal hydride compacts - Preparation, properties and use p 88 A83-27338
- WEIR, A., JR.**
Investigation of methanol as a boiler fuel for electric-power generation [DE82-905495] p 97 N83-16560
- WEISS, R. S.**
Results of the 1982 NASA/JPL balloon flight solar cell calibration program [NASA-CR-170123] p 72 N83-21510
- WELLER, S. W.**
Catalytic coal liquefaction [DE83-001098] p 127 N83-21078
Catalytic coal liquefaction [DE82-012562] p 139 N83-22363
- WELLS, D.**
Stirling engines for solar power generation in the 50 to 500 kW range p 50 A83-27274
- WEN, C. S.**
Solvent-Refined-Coal (SRC) Process Coking of SRC-2 process streams Part 3 Effects of coal minerals on coking Part 4 Thermal properties of SRC-2 cokes and process streams [DE82-012369] p 104 N83-17657
- WENDELL, J. H.**
Simplified aeroelastic modeling of horizontal axis wind turbines [NASA-CR-168109] p 178 N83-21509
- WENDELL, L. L.**
The Wind Characteristics Program [DE82-005226] p 101 N83-17023
- WENDT, R. L.**
Use of vegetation to ameliorate building microclimates An assessment of energy-conservation potentials [DE82-013255] p 32 N83-21572
- WENGLARZ, R. A.**
Evaluation of gasification and gas cleanup processes for use in molten carbonate fuel cell power plants [DE83-003821] p 183 N83-22787
- WENSIERSKI, P.**
Practical and theoretical analysis of continuous selection of temperature layers in a hot tank by an experimental tank and a simulation model [BMFT-FB-T-82-171] p 13 N83-17842
- WENZ, W.**
Construction and operation of a central heating plant prototype heated by coal dust corresponding to the Schoppe system [BMFT-FB-T-82-176] p 109 N83-18031
- WESCOTT, E. M.**
Geothermal energy resource assessment of parts of Alaska [DE83-000140] p 116 N83-19299
- WEST, C. D.**
Performance characteristics of wet and dry fluidynes p 156 A83-27276
Heat-activated heat-pump development and potential application of Stirling-engine technology [DE83-002134] p 183 N83-22817
- WEST, R. E.**
Reversible chemical reactions for energy storage in a large-scale heat utility p 51 A83-27315
- WESTERKAMP, E. J.**
The response of a 38m horizontal axis teetered rotor to yaw p 169 N83-19232
- WESTMORELAND, C. G.**
New physical-chemical reactions useful for TES [DE82-020807] p 195 N83-20432
- WESTON, A. R.**
An on-board near-optimal climb-dash energy management [NASA-CR-169755] p 4 N83-16329
- WHALEY, T. P.**
Status of the cadmium thermoelectrochemical hydrogen cycle [DE83-900088] p 89 N83-22349
- WHISMAN, M. L.**
Trends in motor gasolines, 1942 - 1981 [DE82-021124] p 96 N83-16550
- WHITE, D. H.**
Irrigation pumping using geothermal energy [DE83-005308] p 135 N83-21641
- WHITE, M. A.**
Design of hydraulic output unit for 15 kW free-piston Stirling engine p 157 A83-27277
Development of a quiet Stirling cycle multi-fuel engine for electric power generation [AD-A121033] p 174 N83-19278
- WHITEHEAD, L. T.**
Energy data base guide to abstracting and indexing [DE82-005748] p 200 N83-20821
- WHITELAW, J. H.**
Premixed, turbulent combustion of a sudden-expansion flow p 92 A83-23748
- WIBLE, P.**
Nuclear power compared with other energy sources A brief comparative study of some of the risks [BLL-CE-TRANS-7745-(9022 09)] p 31 N83-21501
- WIDEN, A.**
Laser depth sounding for locating oil below water surface A preliminary survey [FOA-C-30290-E1] p 98 N83-16753
- WIECZINSKI, D. E.**
Combustion of solvent-refined coal in a 100 HP firetube boiler [DE82-007670] p 103 N83-17640
- WILDMAN, D. J.**
Combustion of solvent-refined coal in a 100 HP firetube boiler [DE82-007670] p 103 N83-17640
- WILEMSKI, G.**
Molten carbonate fuel cell performance model p 149 A83-19884
Simple porous electrode models for molten carbonate fuel cells p 149 A83-19891
Systems analysis of on-site integrated energy systems, phase I [DE83-000044] p 179 N83-21549
- WILHELM, A.**
Extraction of coal with solvents in liquid and supercritical state under nonhydrogenating and hydrogenating conditions [BMFT-FB-T-82-177] p 109 N83-18032
- WILHELM, H.**
Pre-feasibility study for construction of a commercial coal hydrogenation plant [BMFT-FB-T-82-190] p 109 N83-18034
- WILHELM, W. G.**
Flat-plate solar collectors utilizing polymers film for high performance and very low cost [DE82-004797] p 56 N83-16877
Low-cost, high-performance solar flat-plate collectors for applications in northern latitudes [DE82-010626] p 71 N83-20428
Development of polymer film solar collectors A status report [DE83-005995] p 80 N83-21643
- WILKEY, M. L.**
Methane from landfills Preliminary assessment workbook [DE83-002319] p 111 N83-18075
- WILKINS, D. E.**
Dynamic simulation of sulfur-removal systems [DE82-902074] p 119 N83-19865
- WILLIAMS, A. E.**
Oxygen isotope exchange in rocks and minerals from the Cerro Prieto geothermal system Indicators of temperature distribution and fluid flow [DE82-001077] p 100 N83-16907
- WILLIAMS, J. H.**
Solar-augmented applications in industry Phase 2 Conceptual designs, volume 1 [PB83-102301] p 72 N83-20441
- WILLIAMS, M. C.**
Anti-misting additives for jet fuels [NASA-CR-169751] p 94 N83-16417
Viscometric and misting properties of polymer-modified fuel [NASA-CR-169750] p 96 N83-16543
- WILLIAMS, T. A.**
Overview of existing residential energy-efficiency rating systems and measuring tools [DE83-003148] p 20 N83-19289

- WILLIAMS, T. R.**
Gran boundary effects in polycrystalline silicon solar cells I - Solution of the three-dimensional diffusion equation by the Green's function method II - Numerical calculation of the limiting parameters and maximum efficiency p 52 A83-27981
- WILLIAMSON, J.**
SOLERAS solar active cooling field test operations p 48 A83-27239
- WILLKE, T. L.**
New priorities in energy-conservation research and development [DE82-005988] p 16 N83-18054
- WILLSON, W. G.**
Liquefaction behavior of a Canadian subbituminous coal in comparison with several US lignites and subbituminous coals [DE82-021976] p 146 N83-22824
- WILSON, B. W.**
Identification and mutagenicity of nitrogen-containing polycyclic aromatic compounds in synthetic fuels [DE82-006173] p 106 N83-17739
- WILSON, D. P.**
Sperry low-temperature geothermal conversion system Volume 1 Organic-working-fluid properties [DE82-018529] p 163 N83-16867
- WILSON, J. E.**
Federal applications for wind energy systems A subcontract report [DE83-000306] p 31 N83-21543
- WILSON, R. K.**
Contact stresses on a thin plate after large displacements to a half parabolic surface [DE82-006998] p 63 N83-19136
Effects of gaps in adhesives that bond elastically deformed panels to parabolic, cylindrical substructures [DE82-014720] p 72 N83-21154
Deformation of a thin, elastic plate to a deep parabolic cylinder [DE82-012056] p 72 N83-21413
- WILSON, T. G.**
Research on spacecraft electrical power conversion [NASA-CR-169974] p 20 N83-19227
- WILZBACH, K. E.**
Toxicology of coal gasification Chemical characterization p 148 N83-22960
- WINDHEIM, R.**
Electricity from wind - A survey of the state of the art and future prospects for research and development [DGLR PAPER 82-081] p 152 A83-24202
Construction, testing and development of large wind energy facilities [NASA-TM-76933] p 163 N83-16855
- WINKELMAN, J. R.**
Control design for a wind turbine-generator using output feedback p 152 A83-24721
Control design and performance analysis of a 6 MW wind turbine-generator p 162 A83-29897
- WINN, C. B.**
Optimal control of solar heating and off-peak energy storage installations p 42 A83-23882
- WINN, R. C.**
Optimal control of solar heating and off-peak energy storage installations p 42 A83-23882
- WINNICK, J.**
Porous perovskite electrode as molten carbonate cathode p 150 A83-20596
- WINSTON, R.**
Engineering development studies for integrated evacuated CPC arrays [DE82-013941] p 77 N83-21583
- WISER, W. H.**
Chemistry and catalysis of coal liquefaction Catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels [DE82-012474] p 119 N83-19870
- WISLICKI, B.**
Association-solvation characteristic of fuels and lubricating and hydraulic oils [NASA-TM-76957] p 96 N83-16525
- WITT, C. E.**
Photovoltaic advanced research and development program in the United States [DE83-000307] p 83 N83-22814
- WITTCHOW, E.**
Power plant concepts using new coal conversion technologies [BMFT-FB-T-82-031] p 131 N83-21506
- WITTEN, A. J.**
The implications of a stochastic approach to air-quality regulations [DE83-001636] p 9 N83-16972
- WOHLGEMUTH, J. H.**
Advanced cell designs for welded arrays p 50 A83-27257
- WOLF, L. JR.**
The design, effectiveness and construction of passive-thermal-control roofing shingles [DE83-001465] p 75 N83-21557
- WOLF, T. L.**
Molten carbonate fuel cell performance model p 149 A83-19884
- WOLFE, W. P.**
Aerodynamic tests of Darnes wind turbine blades p 151 A83-23128
- WOLFRAM, J. H.**
Municipal-solid-waste biconversion technologies [DE83-000263] p 100 N83-16893
Design, construction, operation and costs of a modern small-scale fuel-alcohol plant [DE82-011019] p 107 N83-17754
- WOLOSEWICZ, R. M.**
Reliability and design guidelines for combined solar-space-heating and domestic hot-water system [DE83-003341] p 79 N83-21635
- WONG, J. M.**
Fibre composite rotor selection and design /Fibre composite flywheel development program for road vehicle applications/ p 190 A83-27307
- WOO, J. C. H.**
Assessment of battery buses and battery technology [PB82-260019] p 11 N83-17428
- WOOD, R. F.**
Application of laser annealing and laser-induced diffusion to photovoltaic conversion [DE82-006792] p 61 N83-18056
- WOODHEAD, P. M. J.**
Coal-waste artificial-reef program, phase 3 Volume 2 Comprehensive report [DE82-005591] p 8 N83-16954
- WOODLE, A. S.**
Feasibility of applications of microwave technology for nuclear power plant radioactive wastes [DE82-903143] p 29 N83-20744
- WOODROW, J. O., JR.**
Gulf coast ecological inventory user's guide and information base [DE83-900406] p 28 N83-20455
- WOODWARD, P. W.**
Trends in motor gasolines, 1942 - 1981 [DE82-021124] p 96 N83-16550
- WOODY, H. B.**
Test status and experience with the 7.5 megawatt Mod-2 wind turbine cluster p 172 N83-19261
- WORKHOVEN, R. M.**
Performance testing of the Acurex solar collector model 3001-03 [DE82-013389] p 77 N83-21603
- WORTMANN, F. X.**
Advances in wind energy technology [DGLR PAPER 82-082] p 151 A83-24194
- WRIGHT, J. D.**
Direct-contact air/molten salt heat exchange for solar thermal systems p 47 A83-27234
Organic rankine cycle coupled to a solar pond by direct-contact heat exchange - selection of a working fluid [DE82-020998] p 57 N83-16900
- WRIGHT, J. L.**
Heat loss coefficients and effective tau-alpha products for flat-plate collectors with diathermanous covers p 53 A83-28939
- WROBEL, T. F.**
Electrical overstress failure in silicon solar cells [DE83-004475] p 80 N83-21637
- WU, J. S.**
Low-temperature pyrolysis of coal to produce diesel-fuel blends [DE83-001637] p 126 N83-21076
- WU, Y. C. L.**
Cross-sectional current distribution in coal fired diagonal conducting wall MHD generator p 151 A83-23130
- X**
- XIAO, X.-R.**
Electrochemical solar cells using CdSe thin film electrodes p 37 A83-19885
- Y**
- YAKUPKOVIC, J.**
Instrumental methods of analysis of sulfur compounds in synfuel process streams [DE82-011559] p 95 N83-16446
- YAMAGUCHI, K.**
50 kW Stirling engine p 157 A83-27282
- YAMAGUCHI, S.**
50 kW Stirling engine p 157 A83-27282
- YANG, C.**
Current research in advanced water electrolysis in the United States and abroad p 87 A83-27216
- YANG, J. M.**
Photo-induced electron-transfer reactions in heterogeneous media [DE82-005767] p 66 N83-19627
- YANG, R. J.**
Boundary-layer control by means of strong injection [DE82-012547] p 142 N83-22568
- YARGER, H. L.**
Regional interpretation of Kansas aeromagnetic data [DE83-003219] p 136 N83-21701
- YASUDA, K.**
Advanced photovoltaic-trough development [DE82-015646] p 77 N83-21584
- YEBOAH, J.**
Coal pyrolysis by hot solids from a fluidized-bed combustor [DE83-003344] p 117 N83-19829
- YEE, G. G.**
Photochemical storage potential of azobenzenes p 191 A83-28941
- YEN, M.**
Advanced solar/gas desiccant cooling system [PB82-243833] p 62 N83-18968
- YESAVAGE, V. F.**
Phase equilibrium properties of coal derived liquids [DE82-007006] p 102 N83-17638
- YIP, T. W. G.**
Flame acceleration mechanisms under conditions of partial confinement [PB83-109884] p 120 N83-19881
- YOKOYAMA, T.**
Sodium-sulfur battery program in Japan p 189 A83-27175
- YOSHIDA, K.**
Present status of R&D for hydrogen production from water in Japan p 86 A83-23701
- YOSHIMOTO, M.**
Status report on sulfur iodine thermochemical water-splitting cycle [DE82-007164] p 88 N83-17633
- YOSHIZAWA, Y.**
A study on the hydrogen-oxygen diffusion flame in high speed flow p 93 A83-26199
- YOUNG, C.**
Stratigraphic variations in oil-shale fracture properties [DE82-021088] p 136 N83-21702
- YOUNG, R. T.**
Application of laser annealing and laser-induced diffusion to photovoltaic conversion [DE82-006792] p 61 N83-18056
- YOUNGBERG, A. D.**
High resolution seismic survey of the Hanna, Wyoming underground coal gasification area [DE82-006887] p 112 N83-18137
- YUDOW, B. D.**
Status of the cadmium thermoelectrochemical hydrogen cycle [DE83-900088] p 89 N83-22349
- YUNG, C. S.**
Performance simulation of the JPL solar-powered distiller Part 1 Quasi-steady-state conditions p 66 N83-19781
- Z**
- ZACHARAKIS, T. G.**
Geothermal resource assessment of Idaho Springs, Colorado Resource series 16 [DE83-000345] p 110 N83-18073
- ZACKAY, V. F.**
Low-alloy steels for thick-walled pressure vessels [DE83-002547] p 128 N83-21127
- ZAIOV, G. E.**
The kinetics and mechanism of the reaction of ozone with sulphides [BLL-OA-TRANS-1934-(6196 3)] p 94 N83-16411
- ZAININGER, H. W.**
Benefits to utility systems of coproduction of methanol and electricity [DE83-900279] p 101 N83-16913
- ZAKAK, A. I.**
The development of solar-assisted gas-fired appliances, phase 2 [PB82-231663] p 66 N83-19312
- ZANDVLIET, D.**
Finite element analysis of mixed convection applied to the storage of solar energy p 42 A83-23219
- ZAVITSANOS, P. D.**
Coal desulfurization by a microwave process [DE82-007514] p 118 N83-19854

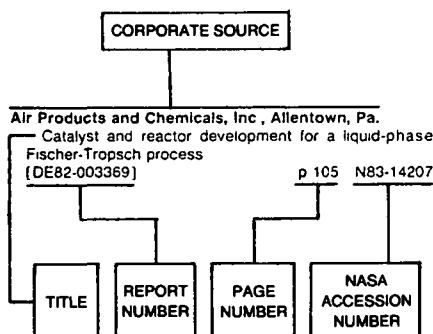
- ZE, F.**
Laser-plasma interaction experiments at laser wavelengths of 1.064 micron, 0.532 micron and 0.355 micron
[DE82-013992] p 175 N83-20114
- ZEHR, F. J.**
Performance and economics of residential solar space heating
[DE83-003187] p 79 N83-21626
- ZEIGHAMI, E. A.**
The implications of a stochastic approach to air-quality regulations
[DE83-001636] p 9 N83-16972
- ZENTNER, R.**
Solar receiver cavity insulation evaluation
p 39 A83-22275
- ZHIDKOV, N. I.**
Possibilities of improving degree of perfection and effectiveness of use of secondary thermal energy resources
[BLL-M-26859-(5825 4)] p 143 N83-22738
- ZIELINSKI, R. E.**
Mass balance results for the Princeton 1 underground coal gasification field test
[DE82-005667] p 162 N83-16556
- ZIMMER, P. B.**
Optimization of solar-selective paint coatings
[DE83-001278] p 80 N83-21642
- ZIMMERMAN, R. E.**
Methane from landfills Preliminary assessment workbook
[DE83-002319] p 111 N83-18075
- ZIMMERMAN, W.**
Automation of the longwall mining system
[NASA-CR-169933] p 114 N83-19183
- ZIMMERMANN, H.**
Replacement of lumpy chrome ore by agglomerated ore concentrates and lowering of specific power consumption and improvement of Cr yield by means of improved slag composition in the production of HC ferrochrome
[BMFT-FB-T-82-084] p 7 N83-16929
- ZINKL, R. J.**
Uranium hydrogeochemical and stream sediment reconnaissance of the St. Michael NTMS quadrangle, Alaska
[DE82-009999] p 99 N83-16844
Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska
[DE82-009666] p 115 N83-19196
Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197
PLTSYM A FORTRAN computer system to plot Canadian symbol location maps for hydrogeochemical and stream-sediment reconnaissance data
[DE83-000764] p 123 N83-20337
- ZINKO, H.**
Solar district heating with evacuated collectors First year experience of the Knivsta plant
[PB82-262114] p 59 N83-16939
- ZIPH, B.**
A new, versatile Stirling energy conversion unit
p 157 A83-27280
- ZWICK, S. A.**
MHD channel electrical boundary-layer theory and applications
p 151 A83-23131
- ZWILLENBERG, M.**
Leachate-treatment technique utilizing fly ash as low-cost sorbent
[DE82-010501] p 111 N83-18101

CORPORATE SOURCE INDEX

ENERGY / A Continuing Bibliography (Issue 38)

JULY 1983

Typical Corporate Source Index Listing



The title of the document is used to provide a brief description of the subject matter. The page number and NASA or AIAA accession number are included in each entry to assist the user in locating the abstract. If applicable, a report number is also included as an aid in identifying the document.

A

- Accumulation-Fabrik A.G., Soest (West Germany).**
Bipolar lead accumulator cell with high energy density [PB82-258757] p 193 N83-16934
- Acurex Corp., Mountain View, Calif.**
Catalyst durability evaluation for advanced gas turbine engines [ASME PAPER 82-JPGC-GT-21] p 152 A83-25270
Advanced photovoltaic-trough development [DE82-015646] p 77 N83-21584
- Advanced Energy and Technology Associates, Dover, N.H.**
Benefits analysis for the production of fuels and chemicals using solar thermal energy [DE83-001023] p 74 N83-21542
- Advanced Systems Associates, Bloomfield Hills, Mich.**
Demonstration of a solar/wind-powered electrostatic-field food-keeping device [DE82-007971] p 65 N83-19285
- Advanced Technology, Inc., McLean, Va.**
Photovoltaic off-farm agricultural applications Volume 1 Executive summary [DE82-008487] p 70 N83-20398
Photovoltaic off-farm agricultural applications Volume 2 Technical report [DE82-009320] p 76 N83-21562
- Aeronautical Research Inst. of Sweden, Stockholm.**
Aeroelastic stability and dynamic response analysis of the LDB-125 vertical axis wind turbine [FFA-TN-1982-19] p 167 N83-18028
- Aerospace Corp., El Segundo, Calif.**
Potential fuel savings through improved airframe maintenance p 11 N83-17456
Assessment of methane-related fuels for automotive fleet vehicles Volume 1 Executive summary [DE83-000280] p 130 N83-21185
Assessment of methane-related fuels for automotive fleet vehicles Volume 2 Technical, supply and economic assessments [DE82-013287] p 142 N83-22467
- Assessment for methane-related fuels for automotive fleet vehicles Volume 3 Appendices** [DE82-013190] p 142 N83-22468
- Aerospace Systems, Inc., Burlington, Mass.**
ASI/Pinson 1-kilowatt high-reliability wind system development Phase 1 Design and analysis [DE82-016128] p 180 N83-21602
- AeroVironment, Inc., Pasadena, Calif.**
Definition of cost-effective river-turbine designs [DE82-010972] p 175 N83-20413
- Air Force Engineering and Services Center, Tyndall AFB, Fla.**
The Second Conference on the Environmental Chemistry of Hydrazine Fuels [AD-A121324] p 13 N83-17731
- Air Products and Chemicals, Inc., Allentown, Pa.**
Liquid-phase methanol process development unit. Installation, operation, and support studies [DE82-012725] p 121 N83-19940
- AirResearch Mfg. Co., Torrance, Calif.**
Solar/gas Brayton/Rankine cycle heat pump assessment [PB83-102319] p 67 N83-19963
Analysis of thermal and mechanical stresses in the ceramic seal of the 1-MW(th) bench model solar receiver [DE82-901870] p 67 N83-20298
Study of vacuum systems for a heat engine/flywheel automotive propulsion system [DE83-002284] p 198 N83-23244
- Alabama Univ., Huntsville.**
Demonstration of modification of a gasoline spark-ignited engine to permit using ethanol as a fuel [DE83-001384] p 114 N83-19101
- Alabama Univ., University.**
Aquifer thermal-energy-storage modeling [DE83-900672] p 197 N83-22794
- Alaska Univ., Fairbanks.**
Geothermal energy resource assessment of parts of Alaska [DE83-000140] p 116 N83-19299
- Alberta Univ., Edmonton.**
Rationale for advances in the technology of IC engines [DE82-000264] p 14 N83-17886
A rationale for advances in the technology of IC engines [DE82-005840] p 14 N83-17889
- Aluminum Co. of America, Alcoa Center, Pa.**
Development and demonstration of process and components for the control of aluminum-air-battery electrolyte composition through the precipitation of aluminum trihydroxide [DE83-002490] p 180 N83-21623
- Ames Lab., Iowa.**
Fossil-energy [DE83-003817] p 124 N83-20383
Study of the electro-winning of copper using a fluidized-bed electrochemical reactor [DE83-004854] p 181 N83-22404
- Andros Analyzers, Inc., Berkeley, Calif.**
Development of a continuous methane monitor [PB82-244245] p 114 N83-19078
- Applied Concepts Corp., Woodstock, Va.**
Thermal system engineering experiment [NASA-CR-169901] p 63 N83-19215
- Arctic Enterprises, Inc., Annapolis, Md.**
Fuel-cell-propelled submarine-tanker-system study [DE82-015149] p 183 N83-22827
- Argonne National Lab., Ill.**
Alkali-metal-vapor removal from pressurized fluidized-bed combustor flue gas [DE82-008088] p 10 N83-16976
The comprehensive community energy management program An evaluation [DE82-011552] p 17 N83-18060
Methane from landfills Preliminary assessment workbook [DE83-002319] p 111 N83-18075
National implications of solar futures A TASE project report [DE82-005122] p 64 N83-19281
- Health and environmental effects document for batteries, 1981 The zinc/halogen batteries** [DE82-006987] p 23 N83-19331
Proceedings of the 1981 Symposium on Instrumentation and Control for Fossil-energy Processes [DE82-011999] p 124 N83-20406
Alaskan coal Resources and developmental constraints [DE83-000860] p 130 N83-21494
Energy from biomass Land analysis and evaluation of supply models [DE83-003333] p 132 N83-21524
A technology assessment of solar energy systems Direct combustion of wood and other biomass in industrial boilers [DE83-000937] p 31 N83-21538
Reliability and design guidelines for combined solar-space-heating and domestic hot-water system [DE83-003341] p 79 N83-21635
Toxicology of coal gasification Chemical characterization p 148 N83-22960
Biostatistics and health impacts of energy technologies p 36 N83-22962
- Artinc Research Corp., Annapolis, Md.**
Guide for the assessment of the availability of gasification-combined-cycle power plants [DE82-901905] p 77 N83-21579
- Arizona Public Service Co., Phoenix.**
Airport solar photovoltaic concentrator [DE83-003137] p 68 N83-20384
- Arizona Scientific Research, Tucson.**
Performance optimization of the ASR optical module [DE83-004477] p 82 N83-22797
- Arizona State Univ., Tempe.**
Performance of an experimental photovoltaic-powered house [DE82-000662] p 58 N83-16908
Analytical and experimental investigations of sodium heat pipes and thermal energy storage systems [AD-A122093] p 195 N83-20375
- Arizona Univ., Tucson.**
Irrigation pumping using geothermal energy [DE83-005308] p 135 N83-21841
- Arkansas State Univ., State University.**
Vaporization thermodynamics of K₂S and K₂SO₃ [NASA-CR-168080] p 117 N83-19812
- Arkansas Univ., Fayetteville.**
Analysis of temperature data from Martin Marietta solar photovoltaic array [DE82-014258] p 69 N83-20389
- Army Cold Regions Research and Engineering Lab., Hanover, N. H.**
Subsea permafrost in Hamson Bay, Alaska An interpretation from seismic data [AD-A121020] p 125 N83-20479
- Army Electronics Research and Development Command, Fort Monmouth, N. J.**
High-cycle-life, high-energy-density nickel-zinc batteries [DE82-012896] p 195 N83-20376
- Artec Associates, Inc., Hayward, Calif.**
High power pulsed plasma MHD experiments [AD-A120526] p 176 N83-20781
High power pulsed plasma MHD experiments [AD-A120526] p 176 N83-20782
- Ashland Synthetic Fuels, Inc., Ky.**
H-Coal Pilot Plant Phase 2 Construction and Phase 3 Operation [DE82-005117] p 106 N83-17732
- Associated Industrial Design, Martinez, Calif.**
Geothermal feasibility study for City of Sonoma, California four municipal buildings [DE82-015115] p 133 N83-21589
- Atlantic Research Corp., Alexandria, Va.**
Further development and evaluation of coal-water mixture technology [DE82-010518] p 106 N83-17736
- Atlas Corp., Santa Cruz, Calif.**
Proceedings of the Fifth Annual Geothermal Conference and Workshop [DE82-901295] p 110 N83-18052

Development of an advanced solar augmented water heater (for single family home applications)
[PB83-119610] p 84 N83-22842

Automation Industries, Inc., Silver Spring, Md.

Environmental data for sites in the National Solar Data Network
[DE82-007055] p 64 N83-19280

Avco-Everett Research Lab., Mass.

MHD channel performance for potential early commercial MHD power plants p 151 N83-23134
Volatile production during preignition coil heating
[DE82-011241] p 95 N83-16445

AEG-Telefunken, Nuremberg (West Germany).

Heating of domestic water by waste heat recovery from household refrigerating equipment
[BMFT-FB-T-82-156] p 7 N83-16930

AEG-Telefunken, Wedel (West Germany).

Technology of elevated voltage solar arrays Key items test and evaluation Part 2 Simulated LEO-plasma tests
[ESA-CR(P)-1646] p 73 N83-21513

AIA Research Corp., Washington, D. C.

New design concepts for energy-conserving buildings Results of a national competition among students in schools of architecture
[DE82-013319] p 24 N83-19950

B**Battelle Columbus Labs., Ohio.**

Biomass cogeneration A business assessment
[DE82-011773] p 101 N83-16928
CaO interactions in the staged combustion of coal
[DE82-010299] p 103 N83-17641
Synthetic-fuel aromaticity and staged combustion
[DE82-010302] p 118 N83-19858
The utilization of emergent aquatic plants for biomass-energy-systems development
[DE82-009174] p 124 N83-20395

Design and market study of photovoltaic systems for commercial building and applications Volume 3 Appendices
[DE82-016729] p 70 N83-20397

Advanced atmospheric fluidized-bed combustion design Ultrahigh velocity
[DE83-004819] p 128 N83-21088

Energy inputs and outputs of fuel-alcohol production, summary volume
[DE83-000367] p 129 N83-21174

Energy inputs and outputs of fuel-alcohol production Appendices A and B, ethanol from grain
[DE83-000368] p 129 N83-21175

Energy inputs and outputs of fuel-alcohol production, appendices G and H Methanol from coal
[DE83-000370] p 130 N83-21177

Energy inputs and outputs of fuel-alcohol production, appendices C through F Methanol from cellulose
[DE83-000369] p 130 N83-21178

Battelle Inst., Frankfurt am Main (West Germany).

Identification of problem areas related to the dispersion of heavy gases p 200 N83-19318

Battelle Pacific Northwest Labs., Richland, Wash.

Western oil-shale development, a technology assessment. Volume 6 Oil-shale development in the Piceance Creek Basin and potential water-quality changes
[DE82-005659] p 108 N83-18009

Energy efficient industrial technology in Europe A compendium
[PB83-102327] p 28 N83-20442

Bechtel Corp., San Francisco, Calif.

Photovoltaic subsystem optimization and design tradeoff study
[DE82-013393] p 69 N83-20392
Study of installed and life-cycle costs for batteries in photovoltaic power systems
[DE83-003849] p 74 N83-21522

Bechtel National, Inc., San Francisco, Calif.

Genenc environmental and safety assessment of 5 battery energy-storage systems
[DE82-902212] p 23 N83-19334

Bendix Corp., Sylmar, Calif.

Description of the 3 MW SWT-3 wind turbine at San Geronimo Pass, California p 172 N83-19258

Bendix Field Engineering Corp., Grand Junction, Colo.
Survey of lands held for uranium exploration, development and production in fourteen western states for the six-month period ending June 30, 1981
[DE82-006228] p 99 N83-16838

Uranium hydrogeochemical and stream sediment reconnaissance of the St. Michael NTMS quadrangle, Alaska
[DE82-009999] p 99 N83-16844

Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska
[DE82-009666] p 115 N83-19196

Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197

PLTSYM A FORTRAN computer system to plot Canadian symbol location maps for hydrogeochemical and stream-sediment reconnaissance data
[DE83-000764] p 123 N83-20337

Bevilacqua (O. M.) and Associates, Oakland, Calif.

Electric vehicles in electric utilities A national survey
[DE82-901285] p 5 N83-16655

Bi-State Development Agency, St. Louis, Mo.

Bi-state solid-waste-to-energy project
[DE83-004458] p 28 N83-20435

Boeing Aerospace Co., Seattle, Wash.

Improved thermophotovoltaic power system
p 46 A83-27139

Boeing Co., Seattle, Wash.

Solar project description for environmental partnership, Upper Freehold Township, Monmouth County, New Jersey
[DE83-001068] p 58 N83-16911

Helio-Thermics, Inc., lot no 8, single family residence, Greenville, South Carolina
[DE82-012822] p 65 N83-19283

Solar project description for Gill Harrop Builders single-family detached residence, Big Flats, New York
[DE82-014984] p 77 N83-21570

Boeing Computer Services, Inc., Seattle, Wash.

Intermediate photovoltaic system application experiment operational performance report for Lovington Square Shopping Center, Lovington, New Mexico
[DE83-000391] p 57 N83-16896

Intermediate photovoltaic system application experiment operational performance report Volume 1 G N Wilcox Memorial Hospital, Kauai, Hawaii
[DE83-000393] p 57 N83-16897

Intermediate photovoltaic system application experiment operational performance report Volume 5 for Lovington Square Shopping Center, Lovington, NM
[DE82-006877] p 65 N83-19286

Intermediate photovoltaic system application experiment operational performance report Volume 3 For Mississippi County Community College, Blytheville, Arkansas
[DE83-000072] p 65 N83-19293

Intermediate photovoltaic system application experiment operational performance report Volume 6 Beverly High School, Beverly, Mass
[DE82-014710] p 69 N83-20391

Intermediate photovoltaic system application experiment operational performance report Volume 5 For CDC Light Manufacturing Building, San Bernardino, California, for July 1982
[DE83-003801] p 73 N83-21517

Intermediate photovoltaic system application experiment operational performance report Volume 2 G N Wilcox Memorial Hospital, Kauai, Hawaii
[DE83-002139] p 74 N83-21541

Intermediate photovoltaic system application experiment operational performance report Volume 5 Beverly High School, Beverly Massachusetts, Executive summary
[DE82-014711] p 76 N83-21563

Intermediate photovoltaic system application experiment operational executive summary Volume 7 Newman Power Station, El Paso, Texas
[DE82-014647] p 76 N83-21564

Intermediate photovoltaic system application experiment operational performance report for CDC Light Manufacturing Building, San Bernardino, California
[DE83-002529] p 78 N83-21605

Intermediate photovoltaic system application experiment operational performance report for Oklahoma Center for Science and Arts for June, July, and August 1982
[DE83-003668] p 78 N83-21606

Intermediate photovoltaic system application experiment operational performance report. Volume 5, for Beverly High School, Beverly, Mass
[DE82-012058] p 81 N83-22774

Intermediate photovoltaic system application experiment operational performance report Volume 1 Dallas - Fort Worth Regional Airport, Texas, July 1982
[DE83-004763] p 84 N83-22819

Intermediate photovoltaic system application experiment operational performance report Volume 3 For G N Wilcox Memorial Hospital, Kauai, Hawaii
[DE83-000801] p 84 N83-22830

Boeing Engineering and Construction Co., Seattle, Wash.

The 1-MW(th) solar-thermal conversion full-system experiment
[DE82-906454] p 59 N83-16920

Development tests for the 2.5 megawatt Mod-2 wind turbine generator p 172 N83-19260

Conceptual design of the 7 megawatt Mod-5B wind turbine generator p 173 N83-19272

Photovoltaic concentrator with plastic-film reflector
[DE83-001715] p 75 N83-21547

Boeing Engineering and Construction Co., Tukwila, Wash.

Test status and experience with the 7.5 megawatt Mod-2 wind turbine cluster p 172 N83-19261

Boeing Military Airplane Development, Seattle, Wash.
Fuel/engine/airframe trade-off study Operational effects of increased freeze point fuels
[AD-A121688] p 129 N83-21169

Bonn Univ. (West Germany).

Initial utility experience with cluster of three Mod-2 wind turbine systems p 173 N83-19268

Fundamental research on Fischer-Tropsch synthesis
[BMFT-FB-T-82-020] p 125 N83-21052

Booz-Allen and Hamilton, Inc., Bethesda, Md.

Competitive assessment of desiccant solar/gas systems for single family residences
[PB82-243825] p 62 N83-18967

Bosch (Robert) G.m.b.H., Gerlingen (West Germany).
Developments and applications of tantalum thin films and hybrid technology
[BMFT-FB-T-82-173] p 199 N83-17686

Boyce Engineering International, Inc., Houston, Tex.
External combustion steam injected gas turbine
[DE82-019862] p 168 N83-19102

Brigham Young Univ., Provo, Utah.

Identification and mutagenicity of nitrogen-containing polycyclic aromatic compounds in synthetic fuels
[DE82-006173] p 106 N83-17739

Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 2 User's manual for a computer program for 1-dimensional coal combustion or gasification (1-DICOG)
[DE82-015610] p 119 N83-19868

Prediction and measurement of optimum operating conditions for entrained coal-gasification processes Volume 3 User's manual for a computer program for 2-Dimensional Coal Gasification or Combustion (PCGC-2)
[DE82-015611] p 119 N83-19869

Basic combustion and pollutant-formation processes for pulverized fuels
[DE82-013773] p 29 N83-20457

Combustion research needs
[PB83-107813] p 128 N83-21091

British Library Lending Div., Boston Spa (England).

Utilization of secondary energy resources at Magnitogorsk Metallurgical Combine
[BLL-M-26856-(5828 4)] p 131 N83-21502

Higher level of utilization of fuel-energy resources
[BLL-M-26855-(5825 4)] p 35 N83-22737

Possibilities of improving degree of perfection and effectiveness of use of secondary thermal energy resources
[BLL-M-26859-(5825 4)] p 143 N83-22738

Brookhaven National Lab., Upton, N. Y.

Design and construction of a demonstration residence utilizing natural thermal storage
[DE82-005508] p 5 N83-16569

Optimal heat pumps for solar-assisted heat-pump systems
[DE82-004798] p 55 N83-16688

Flat-plate solar collectors utilizing polymenc film for high performance and very low cost
[DE82-004797] p 56 N83-16877

Thermal performance of the Brookhaven natural thermal storage house
[DE82-005507] p 56 N83-16879

Modeling energy/economy interactions for conservation and renewable energy-policy analysis
[DE82-009159] p 7 N83-16926

HYFIRE A Tokamak/high-temperature electrolysis system
[DE82-004806] p 88 N83-17323

Metallurgical aspects of interstrand resistance
[DE82-005504] p 186 N83-17342

Systems analysis of hydrogen supplementation in natural gas pipelines
[DE82-006933] p 89 N83-17740

An analysis of selected surface characteristics and latent heat storage for passive solar space heating
[DE82-006932] p 61 N83-18049

Model simplification to examine the interrelationships between coal, gas and oil use
[DE82-007816] p 110 N83-18061

- National implications of solar futures A TASE project report
[DE82-005122] p 64 N83-19281
- Supernsulated homes in North America. A review and update
[DE82-011565] p 21 N83-19290
- Steady-state testing of an advanced solar-assisted heat pump
[DE83-002343] p 66 N83-19297
- Energy planning for development. Needs and approaches
[DE82-014180] p 26 N83-20420
- Low-cost, high-performance solar flat-plate collectors for applications in northern latitudes
[DE82-010626] p 71 N83-20428
- Development of polymer film solar collectors. A status report
[DE83-005995] p 80 N83-21643
- Flash pyrolysis of biomass with reactive and non-reactive gases
[DE83-001850] p 137 N83-22336
- Nickel-zinc batteries
[DE83-000208] p 197 N83-22770
- Instrumentation of the Brookhaven Natural Thermal Storage House
[DE83-000267] p 198 N83-22815
- HYFIRE A Tokamak/high-temperature electrolysis system
[DE82-013851] p 90 N83-23173
- Brooklyn Union Gas Co., N. Y.**
Landfill gas to electricity demonstration project
[PB82-255290] p 7 N83-16943
- Brown Boveri Corp., North Brunswick, N.J.**
Preliminary design study of compressed-air energy storage in a salt dome Volume 6 CAES plant design
[DE82-014355] p 196 N83-21580
- Brown Univ., Providence, R. I.**
Interdisciplinary research covering plasticity of solids, fracture of solids, inorganic glasses, and lower dimensionality materials and structures
[AD-A113883] p 72 N83-20802
- Budd Co., Fort Washington, Pa.**
Design and evaluation of low-cost stainless steel fiberglass foam blades for large wind driven generating systems
[NASA-CR-165491] p 169 N83-19226
- Budd Co., Philadelphia, Pa.**
Design and evaluation of low cost blades for large wind driven generating systems p 170 N83-19244
- Bureau of Reclamation, Denver, Colo.**
WTS-4 system verification unit for wind/hydroelectric integration study p 173 N83-19267
- Burns and Roe Industrial Services Corp., Paramus, N. J.**
Critique of conceptual design for removal of sodium from lignite by ion exchange
[DE82-010789] p 95 N83-16439
- Burt, Hill, Koser, Rittelman and Associates, Washington, D.C.**
Performance evaluation manual for submetered data collection
[DE82-011223] p 70 N83-20402
- Burt, Hill, Koser, Rittelman, and Associates, Butler, Pa.**
Automated installation methods for photovoltaic arrays
[DE83-004272] p 82 N83-22796
- BDM Corp., Albuquerque, N. Mex.**
Design and fabrication of a prototype system for photovoltaic residences in the southwest
[DE83-003935] p 72 N83-21200

C

- California Energy Commission, Sacramento.**
Cogeneration in Municipalities Proceedings from Workshops for Local Governments and Municipal Utilities
[DE82-905758] p 6 N83-16921
- Geothermal Energy, Opportunities for California Business A two-day Conference on Direct Utilization of Geothermal Energy
[DE82-012553] p 147 N83-22826
- California Univ., Berkeley.**
Anti-misting additives for jet fuels
[NASA-CR-169751] p 94 N83-16417
- Viscometric and misting properties of polymer-modified fuel
[NASA-CR-169750] p 96 N83-16543
- Linear oil displacement by the emulsion entrainment process
[DE82-007751] p 99 N83-16841
- Low-alloy steels for thick-walled pressure vessels
[DE83-002547] p 128 N83-21127
- Research in transportation engineering in the United States p 37 N83-23208

- California Univ., Berkeley. Lawrence Berkeley Lab.**
Efficient daylighting in thermally controlled environments
[DE82-003045] p 6 N83-16885
- Investigation of intercalated compounds for photoelectrochemical energy storage
[DE83-000543] p 192 N83-16899
- Identification and removal of the organic compounds in coal-conversion condensate waters
[DE82-004825] p 8 N83-16955
- Is nuclear energy an unacceptable hazard to health?
[DE82-004954] p 9 N83-16961
- Radon-daughter exposures in energy-efficient buildings
[DE82-003711] p 9 N83-16964
- Residential end use demand modeling Improvements to the ORNL model
[DE82-004925] p 13 N83-17750
- Energy and life-cycle cost analysis of a six-story office building
[DE82-004840] p 20 N83-18963
- National implications of solar futures A TASE project report
[DE82-005122] p 64 N83-19281
- Photo-induced electron-transfer reactions in heterogeneous media
[DE82-005767] p 66 N83-19627
- Direct liquefaction of biomass Results from operation of continuous bench scale unit in liquefaction of water slurries of Douglas fir wood
[DE82-015703] p 124 N83-20414
- Prospects for the development of non-noble metal catalysts for hydrogen-air fuel cells
[DE82-013875] p 176 N83-20422
- Mathematical modeling of the behavior of geothermal systems under exploitation
[DE82-010925] p 133 N83-21587
- Residential air-to-air heat exchangers A study of the ventilation efficiencies of wall- or window-mounted units
[DE83-004752] p 33 N83-21617
- Boundary-layer control by means of strong injection
[DE82-012547] p 142 N83-22568
- methods for evaluating the DOE
Appropriate-Technology Program A review and compilation of evaluation methods
[DE83-003306] p 145 N83-22781
- California Univ., Irvine.**
Environmental quality research Fate of toxic jet fuel components in aquatic systems
[AD-A122548] p 30 N83-21168
- California Univ., Livermore. Lawrence Livermore Lab.**
Coal as an option for power generation in US territories of the Pacific
[DE82-009482] p 98 N83-18563
- Oil shale project run summary small retort run S-7
[DE82-004731] p 99 N83-16837
- Energy and Technology Review
[DE82-011840] p 164 N83-16922
- Chemical characterization of organic contaminants in groundwater near an underground coal gasification site
[DE82-004822] p 8 N83-16956
- Coatings for laser fusion
[DE82-005698] p 165 N83-17330
- Recent flame-propagation experiments at LLNL within the liquefied gaseous-fuels spill-safety program
[DE82-010729] p 103 N83-17651
- FDAS hardware and firmware description, Liquefied Gaseous Fuels (LGF) data-acquisition system
[DE82-012602] p 107 N83-17741
- US energy flow, 1981
[DE83-001579] p 18 N83-18081
- Cleanup of groundwater contaminated by underground coal gasification
[DE82-005824] p 19 N83-18118
- A brief overview of geophysical probing technology
[DE82-011217] p 19 N83-18133
- Geotoxic materials in the surface environment
[DE82-005855] p 23 N83-18333
- Fusion technology status and requirements
[DE82-010754] p 174 N83-18615
- Laser-plasma interaction experiments at laser wavelengths of 1.064 micron, 0.532 micron and 0.355 micron
[DE82-013992] p 175 N83-20114
- Physics of mirror systems
[DE82-015908] p 176 N83-20770
- Route profile analysis to determine suitability of electric postal-delivery vehicles
[DE82-012216] p 29 N83-20842
- Development and demonstration of process and components for the control of aluminum-air-battery electrolyte composition through the precipitation of aluminum trihydroxide
[DE83-002490] p 180 N83-21623

- Roadway-powered electric-vehicle impact study analysis of selected utility-service areas
[DE83-003143] p 180 N83-22030
- The HFEM monitoring of coal gasification. Rawlins, Wyoming
[DE82-013801] p 142 N83-22466
- Utilization of oil shales and basic research in organic geochemistry p 144 N83-22766
- Fuel-cell technology assessment. Volume 2. Evaluation of Japan
[DE83-004146] p 182 N83-22771
- Fuel-cell technology assessment. Volume 3. Evaluation of Tunisia
[DE83-004294] p 182 N83-22772
- Fuel-cell technology assessment. Volume 5. Evaluation of South Korea
[DE83-004299] p 182 N83-22773
- Fuel-cell technology assessment. Volume 4. Evaluation of Taiwan
[DE83-004160] p 183 N83-22810
- Fuel-cell technology assessment. Volume 1. The potential value of US fuel-cell technology in foreign countries
[DE83-004372] p 183 N83-22820
- Roadway-powered electric-vehicle project
[DE83-003147] p 184 N83-23243
- California Univ., Los Angeles.**
Environmental effects of solar-thermal power systems Ecological observations during early testing of the Barstow 10-MWe pilot STPS
[DE83-004454] p 85 N83-22856
- California Univ., Riverside.**
Oxygen isotope exchange in rocks and minerals from the Cerro Prieto geothermal system Indicators of temperature distribution and fluid flow
[DE82-001077] p 100 N83-16907
- California Univ., Santa Barbara.**
Mass transfer and chemical reaction of gaseous species in non-catalytic and catalytic porous media supporting catalytic and non-catalytic liquids
[DE82-021713] p 95 N83-16427
- Case Western Reserve Univ., Cleveland, Ohio.**
The electrochemical fluorination of polymeric materials for high energy density aqueous and non-aqueous battery and fuel cell separators
[NASA-CR-167961] p 177 N83-21056
- Localized corrosion in materials for geothermal power
[DE82-015608] p 128 N83-21136
- Catalytic, Inc., Wilsonville, Ala.**
SRC-I solvent-refined-coal process Operation of the solvent-refined-coal pilot plant, Wilsonville, Alabama
[DE82-009931] p 137 N83-22337
- 1980 operation of SRC pilot plant, Wilsonville, Alabama
[DE82-008323] p 137 N83-22339
- Catalytic hydrogenation unit studies
[DE83-003390] p 137 N83-22342
- Center for Renewable Resources, Washington, D.C.**
Putting renewable energy to work in cities
[DE82-016178] p 27 N83-20427
- Central Electricity Generating Board, London (England).**
Evaluation of deterioration due to hot creep in chrome-molybdenum ferritic steels used in thermal power stations
[BLL-CE-TRANS-7669-(9022 09)] p 162 N83-16470
- Desulphurisation of solid fuels in power stations by superconductive magnets
[BLL-CE-TRANS-7855-(9022 09)] p 125 N83-21051
- Nuclear power compared with other energy sources A brief comparative study of some of the risks
[BLL-CE-TRANS-7745-(9022 09)] p 31 N83-21501
- Central Inst. for Industrial Research, Oslo (Norway).**
Wave model A numerical model for the frictional absorption of water waves
[PB83-100792] p 122 N83-20073
- Central Wayne County Sanitation Authority, Dearborn Heights, Mich.**
Energy recovery and cogeneration from an existing municipal incinerator Phase 2A Final design
[DE82-007911] p 179 N83-21577
- Charles River Associates, Inc., Boston, Mass.**
Analytical and policy issues in energy economics Uses of the FRS data base
[DE82-004258] p 16 N83-18051
- Study to establish cost predictions for the production of Redox chemicals
[NASA-CR-167882] p 194 N83-20359
- Chem-Nuclear Systems, Inc., Bellevue, Wash.**
Feasibility of applications of microwave technology for nuclear power plant radioactive wastes
[DE82-903143] p 29 N83-20744

D

Chemapec, Inc., Woodbury, N.Y.

Technical/commercial feasibility study of the production of fuel-grade ethanol from corn. 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana. Volume 1 Executive summary [DE83-000777] p 132 N83-21531

Technical/commercial feasibility study of the production of fuel-grade ethanol from corn. 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana [DE83-000778] p 132 N83-21532

Technical/commercial feasibility study of the production of fuel-grade ethanol from corn. 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana [DE83-000775] p 132 N83-21533

Technical/commercial feasibility study of the production of fuel-grade ethanol from corn. 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana. Volume 5 Appendices [DE83-000773] p 133 N83-21534

Technical/commercial feasibility study of the production of fuel-grade ethanol from corn. 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana [DE83-000774] p 133 N83-21535

Chemische Werke, Huels (West Germany).

Pre-feasibility study for construction of a commercial coal hydrogenation plant [BMFT-FB-T-82-190] p 109 N83-18034

Chicago Univ., Ill. Engineering development studies for integrated evacuated CPC arrays [DE82-013941] p 77 N83-21583

Chromar Corp., Princeton, N.J.

Semiconducting polyacetylene materials for energy-conversion applications [DE82-012320] p 70 N83-20407

Civil Aviation Authority, London (England).

Fuel conservation and economy constraints p 34 N83-22179

Cleveland State Univ., Ohio.

Performance degradation and cleaning of photovoltaic arrays p 48 N83-27236

Colorado School of Mines, Golden.

Phase equilibrium properties of coal derived liquids [DE82-007006] p 102 N83-17638

Mechanisms and kinetics of coal hydrogenation [DE82-012338] p 105 N83-17677

Studies of the mechanisms of turbine fuel instability [NASA-CR-167963] p 114 N83-18924

Colorado State Univ., Fort Collins.

Environmental radiation surveillance program [DE82-902009] p 19 N83-18116

The effects of atmospheric variability on energy utilization and conservation p 31 N83-21525

Stratigraphic variations in oil-shale fracture properties [DE82-021088] p 136 N83-21702

Methanol production from fermentor off-gases [DE83-005011] p 145 N83-22793

Columbia Gas Corp., Ohio.

Research, development and demonstration of an advanced actuated heat pump [PB82-254590] p 164 N83-16932

Combustion Engineering, Inc., Windsor, Conn.

Effect of liquefaction processing conditions on combustion characteristics of solvent-refined coal [DE82-903665] p 139 N83-22361

Commerce Dept., Washington, D.C.

US energy for the rest of the century [PB83-114603] p 36 N83-22838

Commission of the European Communities, Luxembourg.

Investigation of latent heat storage materials in the medium and high temperature range [PB82-259896] p 193 N83-16933

Industrial technology for economic and viable encapsulation for large solar panels [PB82-259839] p 59 N83-16936

Investigation and development of systems for the storage of thermal energy in the temperature range from -25 deg C to +150 deg C [PB82-255258] p 193 N83-16949

Committee on Energy and Commerce (U. S. House).

Cogeneration and small power production [GPO-99-464] p 35 N83-22752

Committee on Energy and Natural Resources (U.S. Senate).

World petroleum outlook, 1982 [GPO-95-066] p 35 N83-22753

Acid precipitation and the use of fossil fuels [GPO-98-172] p 36 N83-22846

Committee on Governmental Affairs (U. S. Senate).

Critical need for energy research and development: The role of the Midwest Research Laboratories [GPO-11-308] p 169 N83-19229

Committee on Science and Technology (U. S. House).

The socioeconomic impacts of synthetic fuels [GPO-99-702] p 24 N83-19923

US electric power system reliability [GPO-99-628] p 24 N83-20002

Diesel technology [GPO-99-748] p 25 N83-20151

The role of business incentives in the development of renewable energy technologies [GPO-99-651] p 25 N83-20364

The natural gas option New resources and new technologies [GPO-99-979] p 123 N83-20365

Coal research [GPO-99-879] p 123 N83-20366

Renewable energy in the eighties Needs for further R and D [GPO-99-663] p 25 N83-20367

US solar and conservation technologies in international markets [GPO-99-627] p 25 N83-20369

Building energy research [GPO-11-221] p 25 N83-20370

Energy-efficient technology: Advancing US competitiveness and productivity [GPO-98-637] p 25 N83-20371

Fiscal year 1983 Department of Energy budget review. Magnetic fusion energy Volume 5 [GPO-98-550] p 175 N83-20372

American technology transfer and Soviet energy planning [GPO-97-481] p 26 N83-20373

Comptroller General of the United States, Washington, D.C.

Status of the Great Plains Coal Gasification Project, August 1982 [GAO/EMD-82-117] p 115 N83-19230

Consolidated Corp., Wheaton, Md.

Ownership and usage of small passenger vehicles: Findings from the 1977 National Personal Transportation Study [DE82-011045] p 20 N83-18592

Cooper Union for the Advancement of Science and Art, New York.

Using a global hydrogen-air combustion model in turbulent reacting flow calculations p 86 N83-24667

Cornell Univ., Ithaca, N. Y.

The structure of 110 tilt boundaries in large area solar silicon [NASA-CR-170204] p 81 N83-22744

Corporate-Tech Planning, Inc., Waltham, Mass.

The assessment of variable valve timing of internal combustion engines for fuel economy improvements and practicability [PB82-265364] p 5 N83-16766

Review and evaluation of automotive fuel technologies Volume 1 Summary [PB83-101147] p 30 N83-20845

Council for Scientific and Industrial Research, Pretoria (South Africa).

Annual Transportation Convention, volume 2 Session F Energy and Transportation Engineering Session G Transport Planning [CSIR-S-313-VOL-2] p 37 N83-23212

Alternative motor fuels p 148 N83-23214

CACI, Inc. - Federal, Arlington, Va.

Transportation network models for energy supply analysis Volume 1 Executive summary [DE82-903077] p 187 N83-20399

Transportation network models for energy supply analysis Volume 3 Transportation network model user's guide and documentation [DE82-903079] p 187 N83-20400

CACI, Inc. - Federal, San Diego, Calif.

Production costing of an Advanced/Innovative Wind Energy Concept (AIWEC) Extension of the SAMICS methodology [DE83-003085] p 182 N83-22783

CER Corp., Las Vegas, Nev.

A geologic study of the Michigan Basin [PB83-136291] p 147 N83-22896

A geologic study of the Raton Basin [PB83-136275] p 147 N83-22903

A geologic study of the Black Warrior Basin [PB83-136283] p 147 N83-22904

CSI Resource Systems, Inc., Boston, Mass.

B-state solid-waste-to-energy project [DE83-004458] p 28 N83-20435

Daimler-Benz A. G., Stuttgart (West Germany).

Prospects of motor vehicles as a means of transportation and of alternative drives p 148 N83-23215

Dames and Moore, Bethesda, Md.

Gulf coast ecological inventory user's guide and information base [DE83-900408] p 28 N83-20455

Dames and Moore, Washington, D. C.

Environmental impacts of undergrounding high-voltage transmission Health and safety [DE82-010108] p 186 N83-18102

Decision Focus, Inc., Palo Alto, Calif.

Integrated forecasting model synthetic fuels study Volume 1 Overview and findings [DE82-903574] p 121 N83-19943

Delaware Div. of Facilities Management, Dover.

Geothermal Energy Tomorrow's Alternative Today A handbook for geothermal-energy development in Delaware [DE83-002987] p 35 N83-22782

Delaware Univ., Newark.

Design rules for a 100X maximum efficiency GaAs concentrator solar cell for space applications [NASA-CR-170005] p 67 N83-20362

Department of Energy (US), London (England).

Development of the oil and gas resources of the United Kingdom A report to Parliament by the Secretary of State for Energy [ISBN-0-11-411123-5] p 14 N83-18017

Advisory Council on energy conservation Report to the Secretary of State for Energy [EP-49] p 14 N83-18018

Digest of United Kingdom Energy Statistics, 1982 [ISBN-0-11-411124-3] p 14 N83-18019

The iron and steel industry Energy consumption and conservation in the iron and steel industry [ENERGY-AUDIT-SER-16] p 14 N83-18020

Department of Energy, Bartlesville, Okla.

Trends in motor gasoline, 1942 - 1981 [DE82-021124] p 96 N83-16550

Motor gasoline, summer 1981 [DE82-014425] p 121 N83-19924

Liquid fossil-fuel technology [DE83-002501] p 121 N83-19937

Bartlesville Energy Technology Center enhanced oil recovery project data base [DE82-012568] p 123 N83-20333

Waste lubricating oil An annotated review, 1982 revision [DE83-001439] p 30 N83-21156

Department of Energy, Grand Forks, N. Dak.

Effects of several disposable catalysts on liquefaction of lignite [DE82-022188] p 138 N83-22351

Liquefaction behavior of a Canadian subbituminous coal in comparison with several US lignites and subbituminous coals [DE82-021976] p 146 N83-22824

Department of Energy, Houston, Tex.

The variable pressure supercritical Rankine cycle for integrated natural gas and power production from the geopressed geothermal resource [DE82-008957] p 179 N83-21591

Department of Energy, Laramie, Wyo.

Simulated in situ retorting of oil-shale in a controlled-state retort. 3 Dynamic oil film thickness on partially retorted and unretorted shale [DE82-011107] p 108 N83-18008

High resolution seismic survey of the Hanna, Wyoming underground coal gasification area [DE82-006887] p 112 N83-18137

Reverse-combustion, horizontal retorting of oil shale [DE83-000018] p 137 N83-22350

Department of Energy, Morgantown, W. Va.

Advanced gasification projects [DE83-003616] p 126 N83-21069

Methane Hydrates Workshop Technical Proceedings [DE83-000580] p 147 N83-22825

Department of Energy, Oak Ridge, Tenn.

Energygrams Brief descriptions of energy technology [DE82-003278] p 199 N83-16891

Energygrams Brief descriptions of energy technology [DE82-003277] p 199 N83-16892

Energy data base guide to abstracting and indexing [DE82-005748] p 200 N83-20821

Energygrams Brief descriptions of energy technology [DE83-001868] p 35 N83-22792

Department of Energy, Pittsburgh, Pa.

Test report on the combustion of PERC and LBL wood oils [DE82-004485] p 95 N83-16429

Formation/decomposition of condensable hydrocarbons during the gasification of coal [DE82-014493] p 119 N83-19866

- Transport characteristics of alternate slurry fuels
[DE82-013508] p 121 N83-19939
- Conversion of coal to synthetic fuels
p 144 N83-22768
- Department of Energy, Portland, Oreg.**
Combustion of solvent-refined coal in a 100 HP firetube boiler
[DE82-007670] p 103 N83-17640
- Department of Energy, Washington, D. C.**
Energy projections to the year 2000, July 1982 update
[DE82-022523] p 5 N83-16870
- Symposium on Commercial Aviation Energy Conservation Strategies Papers and presentations
[AD-A107106] p 11 N83-17455
- Program management plan for the conduct of a research, development and demonstration program for improving the safety of nuclear powerplants
[DE82-008776] p 19 N83-18555
- Automation of the longwall mining system
[NASA-CR-169933] p 114 N83-19183
- Photovoltaic array Power conditioner interface characteristics
[NASA-CR-169919] p 64 N83-19225
- Technical documentation for the nonresidential-buildings energy-consumption survey, 1979 - 1980, building characteristics, energy end use and fuel oil tank data, public use data tapes Users' guide
[DE82-012523] p 24 N83-19957
- Materials for Coal Conversion and Utilization
[DE82-013244] p 124 N83-20386
- International energy indicators
[DE82-012504] p 26 N83-20405
- Assessment of the basic energy sciences program Volume 2 Appendices
[DE82-013245] p 26 N83-20419
- Introduction to the nonresidential buildings energy-consumption survey 1979-1980 building characteristics, energy end use and fuel oil tank data Public use data tapes, shoppers' guide
[DE82-012522] p 27 N83-20424
- Costs to reduce sulfur dioxide emissions
[DE82-013309] p 28 N83-20451
- Survey of large combustors Alternative fuel burning capabilities of large boilers in 1979
[DE82-008386] p 127 N83-21079
- US heat-pump research and development projects
[DE83-000943] p 31 N83-21536
- Department of Industry, London (England).**
The iron and steel industry Energy consumption and conservation in the iron and steel industry
[ENERGY-AUDIT-SER-16] p 14 N83-18020
- Deutsche Automobilgesellschaft m.b.H., Esslingen (West Germany).**
Development of gas-phase metallized plaques for electrodes of storage batteries, in particular for nickel oxide electrodes
[PB82-255431] p 193 N83-16950
- Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).**
Activities report in space research in the Federal Republic of Germany p 200 N83-19702
- Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hardthausen (West Germany).**
Thermodynamic model for a central receiver of a solar plant with partial shading of the heliostat field
[DFVLR-FB-82-27] p 73 N83-21515
- Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).**
A highly efficient collector for small solar energy installations
[PB82-255191] p 60 N83-16948
- Drexel Univ., Philadelphia, Pa.**
Droplet size effects on NO/x formation in a one-dimensional monodisperse spray combustion system
[ASME PAPER 82-JPGC-GT-10] p 93 A83-25268
- Du Pont de Nemours (E. I.) and Co., Alken, S.C.**
Fleet experience using a methanol/unleaded gasoline blend
[DE83-003834] p 129 N83-21171
- Radioisotopes for heat-source applications
[DE83-005045] p 137 N83-21934
- Duke Univ., Durham, N. C.**
Research on spacecraft electrical power conversion
[NASA-CR-169974] p 20 N83-19227

E

- E-F Technology, Inc., St Johns, Mich.**
The Alternative Fuels for Medium Speed Diesel Engines (AFFMSDE) project A baseline program planning concept for review and revision
[DE83-002565] p 141 N83-22461

- Earth Sciences Associates, Palo Alto, Calif.**
A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas
[DE83-004095] p 135 N83-21686
- Eastern Air Lines, Inc., Atlanta, Ga.**
Air traffic control Its effect on fuel conservation
p 12 N83-17464
- A practical economic criterion for fuel conservation
p 12 N83-17468
- Economic Research Service, Washington, D. C.**
Progress of solar technology and potential farm uses
[PB83-100065] p 71 N83-20436
- Edaw, Inc., Palo Alto, Calif.**
A comparison of estimated and background subsidence rates in Texas-Louisiana geopressed geothermal areas
[DE83-004095] p 135 N83-21686
- Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.**
Municipal-solid-waste biconversion technologies
[DE83-000263] p 100 N83-16893
- Performance and operational experience of a prototype binary geothermal power plant
[DE82-006289] p 164 N83-16901
- Analyses of mixed hydrocarbon binary thermodynamic cycles for moderate temperature geothermal resources
[DE82-006272] p 164 N83-16904
- Effect of simulated medium-Btu coal gasifier atmospheres on the biaxial stress rupture behavior of four candidate coal gasifier alloys
[DE82-008607] p 104 N83-17661
- Design, construction, operation and costs of a modern small-scale fuel-alcohol plant
[DE82-011019] p 107 N83-17754
- Performance testing of the Acurex solar collector model 3001-03
[DE82-013389] p 77 N83-21603
- Eidgenossische Technische Hochschule, Zurich (Switzerland).**
Supercharging with Compress p 168 N83-18940
- Elmco Mining Machinery International, Salt Lake City, Utah.**
A clean internal combustion engine for underground mining machinery A technical assessment and program plan, phase 1
[PB82-244724] p 89 N83-19104
- Electric Power Research Inst., Palo Alto, Calif.**
Some 2 1/4Cr-1 Mo steels for coal-conversion pressure vessels
[DE82-901349] p 105 N83-17707
- Electricity Council, London (England).**
The kinetics and mechanism of the reaction of ozone with sulphides
[BLL-OA-TRANS-1934-(6196 3)] p 94 N83-16411
- Energy and Minerals Research Co., Exton, Pa.**
Ultrasonically enhanced size reduction of coal
[DE82-008679] p 113 N83-18416
- Energy Engineering, Inc., Albuquerque, N. Mex.**
Additional testing of the passive heat-pipe-cooled solar photovoltaic receiver
[DE-83-004474] p 78 N83-21615
- Energy Research and Development International, Inc., Pittsburgh, Pa.**
Dynamic interaction between an OTEC power plant and a power grid
[DE83-002862] p 183 N83-22784
- Energy Technology Engineering Center, Canoga Park, Calif.**
Solar-collector silicon hose life test
[DE83-002236] p 83 N83-22798
- Energy Utilization Systems, Inc., Pittsburgh, Pa.**
1980 survey and evaluation of utility conservation, load management and solar end-use projects Volume 2 Solar end-use projects
[DE82-901849] p 66 N83-19330
- Engineering and Economics Research, Inc., Vienna, Va.**
Integration of hydrothermal-energy economics Related quantitative studies
[DE83-001407] p 178 N83-21544
- Engineering Societies Library, New York.**
Advanced coal preparation
[DE82-010502] p 97 N83-16561
- Engins Matra, Toulouse (France).**
Energy generating and storing method for space application
p 177 N83-21021
- Environmental Protection Agency, Research Triangle Park, N.C.**
Diesel Emissions Symposium Proceedings
[PB82-244013] p 23 N83-19462
- Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).**
Study based on ammonia/water solutions of a distinct heating transport system
[BMFT-FB-T-82-188] p 186 N83-18033

- Essen Univ. (West Germany).**
Practical and theoretical analysis of continuous selection of temperature layers in a hot tank by an experimental tank and a simulation model
[BMFT-FB-T-82-171] p 13 N83-17842
- European Space Agency, Paris (France).**
Fourth ESTEC spacecraft power-conditioning seminar
[ESA-SP-186] p 176 N83-21006
- Evaluation of various solar-cell-to-interconnector welds by means of scanning laser acoustic microscopy and metallography
[ESA-STM-225] p 73 N83-21514
- Exxon Corp., Florham Park, N.J.**
Advanced solar/gas desiccant cooling system
[PB82-243833] p 62 N83-18968
- Exxon Production Research Company, Houston, Tex.**
Coal geology Who needs it? p 112 N83-18140
- Exxon Research and Engineering Co., Bayton, Tex.**
Catalytic coal gasification An emerging technology for SNG
[DE82-007596] p 104 N83-17676
- Dynamic simulation of Exxon's Catalytic Coal-Gasification process
[DE82-021973] p 146 N83-22823
- Exxon Research and Engineering Co., Florham Park, N.J.**
EDS coal-liquefaction process development Phase 5 EDS environmental program
[DE82-005641] p 12 N83-17673
- EDS coal-liquefaction process development Phase 5 EDS product quality
[DE83-002226] p 117 N83-19827
- EDS coal-liquefaction process development, phase 5
[DE82-012444] p 118 N83-19862
- Exxon Research and Engineering Co., Linden, N.J.**
Synthetic fuel effects in continuous combustion systems An experimental study of fuel nitrogen conversion in jet-stirred combustors
[DE82-002686] p 103 N83-17646
- ECO, Inc., Buzzards Bay, Mass.**
Fuel cell electrolyte for portable electrical generating equipment
[AD-A121176] p 174 N83-19275
- EG and G Automotive Research, Inc., San Antonio, Tex.**
A study of emissions from light duty vehicles in San Antonio, Texas, year 2
[PB83-124743] p 36 N83-22867
- EIC, Inc., Newton, Mass.**
Investigation of intercalated compounds for photoelectrochemical energy storage
[DE83-000543] p 192 N83-16899
- Development of a high capacity toroidal Ni/Cd cell
[NASA-CR-169945] p 174 N83-19273
- Use of inorganic materials for phosphorescent concentrating solar cells
[DE83-002860] p 83 N83-22799

F

- Fachhochschule, Esslingen (West Germany).**
Solar energy plant as a complement to a conventional heating system Measurement of the storage and consumption of solar energy
[PB82-255209] p 59 N83-16946
- Faucett (Jack) Associates, Inc., Chevy Chase, Md.**
Study of domestic social and economic impacts of Ocean Thermal Energy Conversion (OTEC) commercial development Volume 1 Economic impacts
[DE83-001111] p 21 N83-19291
- Study of domestic social and economic impacts of Ocean Thermal Energy Conversion (OTEC) commercial development Volume 2 Industry profiles
[DE83-001112] p 21 N83-19292
- Energy inputs and outputs of fuel-alcohol production, summary volume
[DE83-000367] p 129 N83-21174
- Energy inputs and outputs of fuel-alcohol production Appendices A and B, ethanol from grain
[DE83-000368] p 129 N83-21175
- Energy inputs and outputs of fuel-alcohol production, appendices G and H Methanol from coal
[DE83-000370] p 130 N83-21177
- Energy inputs and outputs of fuel-alcohol production, appendices C through F Methanol from cellulose
[DE83-000369] p 130 N83-21178
- Federal Aviation Administration, Atlantic City, N.J.**
Evaluation of wind-driven retroreflective taxiway edge markers
[DOT/FAA/RD-82/80] p 94 N83-16353
- Federal Aviation Administration, Washington, D.C.**
An overview of the DOT/FAA aviation energy conservation policy p 11 N83-17460

Fenix and Scisson, Inc., Tulsa, Okla.

Preliminary design study of compressed-air energy storage in a salt dome Volume 6 CAES plant design [DE82-014355] p 196 N83-21580

Florida Inst. of Tech., Melbourne.

Advanced thermal-sensor-system development via shuttle sortie missions [DE82-004932] p 98 N83-16834

Florida Solar Energy Center, Cape Canaveral.

Innovative photovoltaic application for residences experiment [DE83-000399] p 57 N83-16898

Florida Univ., Gainesville.

Synthesis and characterization of novel polymers from non-petroleum sources for use in enhanced oil recovery [DE82-008705] p 140 N83-22436

Flow Application Research, Fremont, Calif.

Turbine engine fuel conservation by fan and compressor profile control p 12 N83-17467

Flow Research, Inc., Kent, Wash.

Development of a quiet Stirling cycle multi-fuel engine for electric power generation [AD-A121033] p 174 N83-19278

Foersvarets Forskingsansalt, Stockholm (Sweden).

The importance of satisfactory positioning, diving and mapping systems suitable for exploration and transportation in icecovered sea areas [PB83-109587] p 123 N83-20342

Foster-Miller Associates, Inc., Waltham, Mass.

Design and component testing of a low-temperature waste-heat-driven refrigeration system, phases 1 and 2 [DE82-014721] p 179 N83-21571
Design of hydraulic output Stirling engine [NASA-CR-167976] p 181 N83-22739

Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Stuttgart (West Germany).

Heat energy consumption and intermittent heating [PB82-255159] p 8 N83-16945

Freese-Notis Weather, Inc., Des Moines, Iowa

The useful potential of using existing data to uniquely identify predictable wind events and regimes, part 2 p 116 N83-19251

Frezzolini Electronics, Inc., Hawthorne, N.J.

Sealed mini-nickel cadmium battery charging techniques, technical investigation report [AD-A119826] p 192 N83-16860

G**Garrett Turbine Engine Co., Phoenix, Ariz.**

A method to estimate weight and dimensions of small aircraft propulsion gas turbine engines User's guide [NASA-CR-168049] p 162 N83-16343
Advanced Gas Turbine (AGT) powertrain system development for automotive applications [NASA-CR-167983] p 166 N83-17424
Future of alternate fuels for turbine engines p 141 N83-22453

General Accounting Office, Washington, D. C.

Status of the Great Plains coal gasification project, August 1982 [PB83-115139] p 130 N83-21188

General Atomic Co., San Diego, Calif.

Status report on sulfur iodine thermochemical water-splitting cycle [DE82-007164] p 88 N83-17633

General Electric Co., Cincinnati, Ohio.

Energy efficient engine Fan test hardware detailed design report [NASA-CR-165148] p 4 N83-16341

General Electric Co., Philadelphia, Pa.

Control design and performance analysis of a 6 MW wind turbine-generator p 162 A83-29897
Design study of a high power rotary transformer [NASA-CR-168012] p 186 N83-16630
Experience and assessment of the DOE/NASA Mod-1 2000 kW wind turbine generator at Boone, North Carolina p 172 N83-19257
Conceptual design of the 6 MW Mod-5A wind turbine generator p 173 N83-19271
Initial detailed designs for intermediate photovoltaic systems Branch bank [DE82-005854] p 65 N83-19287
Coal desulfurization by a microwave process [DE82-007514] p 118 N83-19854
Analysis and design of residential load centers Volume 2 Appendices [DE82-014253] p 24 N83-19956
Design of a photovoltaic system for a southeast all-electric residence [DE82-009349] p 69 N83-20394
Initial detailed designs for intermediate photovoltaic systems Warehouse [DE82-014534] p 69 N83-20396

SNG from land-based biomass 1981 program [PB83-10467] p 125 N83-20440
Energy-storage-flywheel housing-design-concept development [DE82-014494] p 196 N83-21574
Manne biomass New York state site and species study compositional analysis and systems studies [PB83-126078] p 142 N83-22470

General Electric Co., Schenectady, N. Y.

Control design for a wind turbine-generator using output feedback p 152 A83-24721
Control design and performance analysis of a 6 MW wind turbine-generator p 162 A83-29897
Stochastic methods for analysis of power flow in electric networks [DE83-000445] p 5 N83-16653

Development of advanced batteries for utility application [DE82-006459] p 193 N83-16918
Catalytic effects of alkali metal salts in the gasification of coal char [DE82-000850] p 103 N83-17645

High-temperature turbine technology program Volume 5 Materials technology development [DE83-004330] p 181 N83-22607

General Electric Co., St. Petersburg, Fla.

Parametric investigations and other related studies of energy storage type capacitors [DE83-003426] p 197 N83-22785

General Research Corp., Santa Barbara, Calif.

Synthetic fuels for transportation Background paper 1 The future potential of electric and hybrid vehicles [PB83-126086] p 37 N83-23250

Geological Survey, Denver, Colo.

Geothermal resource assessment of Idaho Springs, Colorado Resource series 16 [DE83-000345] p 110 N83-18073

Geological Survey, Lawrence, Kans.

Assessment of the geothermal resources of Kansas [DE83-003234] p 145 N83-22790

Geological Survey, Menlo Park, Calif.

Exploration deliberations p 144 N83-22762

Geological Survey, Norman, Okla.

Geothermal resource assessment in Oklahoma [DE82-021288] p 100 N83-16874

Geological Survey, Washington, D. C.

US petroleum exploration Likely targets 1980 - 2000 p 112 N83-18141

Georgia Inst. of Tech., Atlanta.

Design of a vortex-flow solar chemical reactor [DE83-000031] p 58 N83-16914
Solar-energy treatment of ceramic tiles [DE83-000147] p 65 N83-19296

Geothermal Development Associates, Reno, Nev.

A preliminary plan for the development of geothermal energy in the town of Gabbs, Nevada [DE82-007602] p 17 N83-18064

A preliminary plan for the development of geothermal energy in the town of Hawthorne, Nevada [DE82-007594] p 17 N83-18065

Geothermal energy in Nevada Development and utilization [DE83-001783] p 31 N83-21545

Gesellschaft fuer Elektrometallurgie m B.H., Duesseldorf (West Germany).

Replacement of lumpy chrome ore by agglomerated ore concentrates and lowering of specific power consumption and improvement of Cr yield by means of improved slag composition in the production of HC ferrochrome [BMFT-FB-T-82-084] p 7 N83-16929

Gewerkschaft Sophia-Jacoba, Hueckelhoven (West Germany).

Construction and operation of a central heating plant prototype heated by coal dust corresponding to the Schoppe system [BMFT-FB-T-82-176] p 109 N83-18031

Gilbert (Glen A.) and Associates, Inc., Reading, Pa.

Parametric analysis of closed cycle magnetohydrodynamic (MHD) power plants [NASA-CR-165472] p 182 N83-22748

Gilbert/Commonwealth, Reading, Pa.

Program planning for future improvement in managing ORNL's radioactive wastes [DE82-007721] p 19 N83-18467

Governor's Div of Energy Resources, Columbia, S.C. South Carolina energy outlook [DE83-002121] p 32 N83-21561

Grace (W. R.) and Co., Memphis, Tenn.

Process engineering and mechanical design reports Volume 1 Preliminary design and assessment of a 50,000 BPD coal-to-methanol-to-gasoline plant [DE83-000848] p 97 N83-16559

Gruy Federal, Inc., Arlington, Va.

Multiple-task services for the Division of Geothermal Energy's hydrothermal-resources program [DE82-009007] p 110 N83-18070

Gulf Research and Development Co., Pittsburgh, Pa.

Fuel quality-processing study Volume 1 Overview and results [NASA-CR-165326-VOL-1] p 143 N83-22750

Fuel quality-processing study Volume 2 Literature survey [NASA-CR-165326-VOL-2] p 143 N83-22751

Fuel quality-processing study Volume 3 Fuel upgrading studies [NASA-CR-165326-VOL-3] p 144 N83-22754

GKSS-Forschungszentrum Geesthacht (West Germany).

Simulation of air-pollution propagation resulting from at-sea incineration wastes [DE82-902297] p 10 N83-16979

H**Hague International, South Portland, Maine.**

Enhancement of energy savings through accelerated implementation of high-performance forge furnaces [DE82-010913] p 32 N83-21578

Hahn-Jackson-Thresher-Henning, Inc., Evansville, Ind.

Solar-assisted water-source heat pump [DE82-013981] p 81 N83-22567

Hamilton Standard, Windsor Locks, Conn.

Fiberglass composite blades for the 4 MW - WTS-4 wind turbine p 170 N83-19243
Status of the 4 MW WTS-4 wind turbine p 172 N83-19263

Hanford Engineering Development Lab., Richland, Wash.

Assessment of the need for dry cooling, 1981 update [DE82-009395] p 146 N83-22803

Harvard Medical School, Boston, Mass.

Estimating pollutant exposures from coal fired power plants in a rural region [DE82-008136] p 19 N83-18109

Hawaii Inst. of Geophysics, Honolulu.

Preliminary geothermal evaluation of the Mokapu Peninsula on the island of Oahu, Hawaii [AD-A119158] p 117 N83-19378

Health Effects Research Lab., Research Triangle Park, N. C.

Short-Term Bioassays in the Analysis of Complex Environmental Mixtures 2 [PB82-233172] p 23 N83-19420

Hewlett-Packard Co., Cupertino, Calif.

Corrosion of 310 stainless steel in H₂-H₂O-H₂S gas mixtures Studies at constant temperature and fixed oxygen potential p 90 A83-20265

Holmes and Narver, Inc., Las Vegas, Nev.

Colorado geothermal resource assessment Shallow-hole temperature survey Intermediate-depth holes IGH no 1 and no 2, Depth test hole 44X-10 [DE83-002698] p 135 N83-21621

Honeywell, Inc., Minneapolis, Minn.

Optimization of solar-selective paint coatings [DE83-001278] p 80 N83-21642

Honeywell, Inc., Roseville, Minn.

Solar energy system performance evaluation Honeywell OTS 41, Shenandoah (Newman), Georgia [DE82-021004] p 73 N83-21521

Solar-energy-system performance evaluation Honeywell OTS 44, Ocmulgee, Georgia [NASA-CR-170031] p 74 N83-21530

Houston Univ., Tex.

Long term solar irradiation heating of black chrome [DE83-000032] p 58 N83-16909

Hydrocarbon Research, Inc., Lawrenceville, N. J.

Catalytic evaluation for H-coal [DE82-014457] p 138 N83-22355

Idaho National Engineering Lab., Idaho Falls.

Overview of fusion reactor safety [DE82-005951] p 166 N83-17331

Opportunities for direct-contact waste heat recuperators for industrial heat recovery [DE82-006280] p 15 N83-18038

Status of DOE small hydropower research and development projects [DE83-001353] p 125 N83-20434

Illinois Inst. of Natural Resources, Springfield.

Perspectives in Geology Invited papers presented at a symposium in observance of the 75th anniversary of the Illinois State Geological Survey [PB-255589] p 112 N83-18138

Illinois State Geological Survey, Champaign.

- Perspectives in Geology Invited papers presented at a symposium in observance of the 75th anniversary of the Illinois State Geological Survey [PB82-25589] p 112 N83-18138
The Illinois State Geological Survey The next quarter century p 112 N83-18139

Illinois State Univ., Normal.

- Energy-efficient alcohol-fuel production [DE82-011278] p 122 N83-19944

Illinois Univ., Chicago.

- Review of hot-gas-desulfurization simulation models [DE82-016265] p 138 N83-22356

Illinois Univ., Urbana-Champaign.

- Residential and commercial cogeneration systems assessment [PB82-240037] p 22 N83-19314
Flame acceleration mechanisms under conditions of partial confinement [PB83-109884] p 120 N83-19881

Imhausen-Chemie G.m.b.H., Lahr (West Germany)

- Optimizing the combination of a Fischer-Tropsch synthesis with coal hydrogenation for the production of motor fuels [PB82-255167] p 96 N83-16459

Imperial Chemical Industries Ltd., Runcorn (England).

- Introductory lecture Statement of the problem p 200 N83-19317

Indian Inst. of Tech., New Delhi.

- Two level multi-objective reconnaissance system study of a large water resource system [PB82-239716] p 20 N83-19213

Indiana Biolab, Palmyra.

- Microorganisms for fermentation of crop residues [DE82-006912] p 102 N83-17051

Industrial Environmental Research Lab., Research Triangle Park, N. C.

- State-of-the-art combustion modification NOx control for stationary combustion equipment [PB82-240201] p 23 N83-19340

Insights West, Inc., Los Angeles, Calif.

- Solar-augmented applications in industry Phase 2 Conceptual designs, volume 1 [PB83-102301] p 72 N83-20441

Institut fuer Kerntechnik und Energiewandlung e.V., Stuttgart (West Germany).

- Investigation of latent heat storage materials in the medium and high temperature range [PB82-259896] p 193 N83-16833

Institut de Recherche des Transports, Arcueil (France).

- Influence of driver behavior on fuel consumption Bibliographic study [IRT-58] p 11 N83-17086

Institut fuer Kerntechnik und Energiewandlung e.V., Stuttgart (West Germany).

- Motor-fuels for road vehicles [REPT-24] p 140 N83-22440

Institute for Energy Analysis, Oak Ridge, Tenn.

- Electric home heating Substitution for oil and gas [DE82-013762] p 133 N83-21581

Institute of Gas Technology, Chicago, Ill.

- Coal gasification for stationary gas-turbine applications [DE82-902135] p 97 N83-16553
High-temperature composite latent/sensible heat storage [DE82-010396] p 62 N83-18063

Institute of Gas Technology, Chicago, Ill.

- Vehicle conversion to hybrid gasoline/alternative fuel operation [NASA-CR-169911] p 115 N83-19216

Institute of Gas Technology, Chicago, Ill.

- Hybrid fuel cell/diesel generation total energy system, part 2 [NASA-CR-169912] p 115 N83-19217

Institute of Gas Technology, Chicago, Ill.

- Pipeline gas from coal Hydrogenation (IGT hydrogasification process) [DE82-014611] p 121 N83-19941

Institute of Gas Technology, Chicago, Ill.

- Gasification of land-based biomass [PB83-109918] p 122 N83-19946

Institute of Gas Technology, Chicago, Ill.

- Status of the cadmium thermoelectrochemical hydrogen cycle [DE83-900088] p 89 N83-22349

Institute of Gas Technology, Chicago, Ill.

- Hydrogen use in a rural Alaskan community [DE83-000568] p 90 N83-22813

Institute of Gas Technology, Chicago, Ill.

- Multi-fuel low-NOx burner development, phase 2 [PB83-126292] p 147 N83-22845

Institute of Geological Sciences, London (England).

- Investigation of the geothermal potential of the UK The Southampton (Western Esplanade) geothermal well A preliminary assessment of the resource p 109 N83-18029

Institution of Engineers, Calcutta (India).

- Engineering the Future for the Benefit of Mankind, volume 2 [PB82-225491] p 24 N83-19634

Institution of Engineers, Calcutta (India).

- Seminar on Use of High Strength Deformed Bars [PB83-122580] p 34 N83-22486

Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

- Ignition technique for conventional motors by high energy spark [INPE-2645-TDL/116] p 142 N83-22594

Intercomp Resources Development and Engineering Corp., Denver, Colo.

- Reservoir engineering transient pressure well testing, and petrophysical analyses of western gas sands [DE82-004879] p 99 N83-16839

Intercomp Resources Development and Engineering Corp., Denver, Colo.

- Type-curve analysis of pressure buildup from vertically fractured wells in low permeability reservoirs [DE82-010513] p 115 N83-19198

International Coal Refining Co., Allentown, Pa.

- SRC-I project Baseline [DE83-000987] p 127 N83-21086

International Inst. for Applied Systems Analysis, Laxenburg (Austria).

- Two global scenarios The evolution of energy use and the economy to 2030 [IIASA-RR-81-35] p 14 N83-18021

International Inst. for Applied Systems Analysis, Laxenburg (Austria).

- A review of world hydrocarbon resource assessments [DE83-900732] p 131 N83-21499

Iowa State Univ. of Science and Technology, Ames.

- The response of solar cells to microwave radiation [AD-A121813] p 64 N83-19279

IAP Research, Inc., Dayton, Ohio.

- Repetitive switching for inductive energy storage [AD-A121029] p 194 N83-19277

IIT Research Inst., Chicago, Ill.

- Fatigue testing of low-cost fiberglass composite wind turbine blade materials [NASA-CR-165566] p 181 N83-22746

J**Jackson State Univ., Miss.**

- A preliminary study of environmental parameters associated with the feasibility of a polygeneration plant at Kennedy Space Center p 11 N83-17365

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Minimum silicon wafer thickness for ID wafering p 41 A83-22924

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Configuration selection study for isolated loads p 41 A83-23137

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Regional thermal and electric energy output of salt-gradient solar ponds in the U.S. [ASME PAPER 82-WA/SOL-27] p 44 A83-25689

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Comparison of evolving photovoltaic and nuclear power systems for earth orbital applications p 45 A83-27131

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Application of electrochemical energy storage in solar thermal electric generation systems p 47 A83-27179

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Thermoelectric conversion for space nuclear power p 155 A83-27222

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Comparison of advanced thermal and electrical storage for parabolic dish solar thermal power systems p 47 A83-27232

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Evaluation of solar reflective surfaces for dish concentrators p 48 A83-27237

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- U.S. welding technology - Constraints to space implementation p 49 A83-27249

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Space solar cell technology development - A perspective p 49 A83-27255

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Basic investigation into the electrical performance of solid electrolyte membranes [NASA-CR-169790] p 191 N83-16419

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment [NASA-CR-169801] p 191 N83-16858

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- A study of the United States coal resources [NASA-CR-169792] p 101 N83-16993

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Automation of the longwall mining system [NASA-CR-169933] p 114 N83-19183

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Thermal system engineering experiment [NASA-CR-169901] p 63 N83-19215

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Vehicle conversion to hybrid gasoline/alternative fuel operation [NASA-CR-169911] p 115 N83-19216

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Hybrid fuel cell/diesel generation total energy system, part 2 [NASA-CR-169912] p 115 N83-19217

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Large area silicon sheet by EFG [NASA-CR-169920] p 63 N83-19219

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Development of metallization process, FSA project, cell and module formation research area [NASA-CR-169902] p 63 N83-19220

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Process research of non-cz silicon material Low cost solar array project, cell and module formation research area [NASA-CR-169899] p 63 N83-19221

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

- Development of technique for air coating and nickel and copper metallization of solar cells [NASA-CR-169938] p 63 N83-19222

A survey of manufacturers of solar thermal energy systems

- [NASA-CR-169924] p 63 N83-19223

A survey of manufacturers of solar thermal energy systems

- Optimization of dish solar collectors with and without secondary concentrators [NASA-CR-169928] p 64 N83-19224

A survey of manufacturers of solar thermal energy systems

- Photovoltaic array Power conditioner interface characteristics [NASA-CR-169919] p 64 N83-19225

A survey of manufacturers of solar thermal energy systems

- An overview of the Goldstone Energy Systems study p 24 N83-19780

A survey of manufacturers of solar thermal energy systems

- Performance simulation of the JPL solar-powered distiller Part 1 Quasi-steady-state conditions p 66 N83-19781

A survey of manufacturers of solar thermal energy systems

- Combustion engine system [NASA-CASE-NPO-14565-2] p 89 N83-19826

A survey of manufacturers of solar thermal energy systems

- High production shuttle car system for coal mines [NASA-CASE-NPO-15949-1] p 187 N83-20155

A survey of manufacturers of solar thermal energy systems

- Results of the 1982 NASA/JPL balloon flight solar cell calibration program [NASA-CR-170123] p 72 N83-21510

A survey of manufacturers of solar thermal energy systems

- Applications guide for waste heat recovery [NASA-CR-170121] p 178 N83-21511

A survey of manufacturers of solar thermal energy systems

- Review of alternative fuels data bases [NASA-CR-170203] p 140 N83-22439

A survey of manufacturers of solar thermal energy systems

- Lightweight solar array blanket tooling, laser welding and cover process technology [NASA-CR-170209] p 81 N83-22741

A survey of manufacturers of solar thermal energy systems

- Development of technologies for welding interconnects to fifty-micron thick silicon solar cells [NASA-CR-170212] p 81 N83-22742

A survey of manufacturers of solar thermal energy systems

- The structure of 110 tilt boundaries in large area solar silicon [NASA-CR-170204] p 81 N83-22744

A survey of manufacturers of solar thermal energy systems

- Stress studies in EFG [NASA-CR-170205] p 81 N83-22745

A survey of manufacturers of solar thermal energy systems

- Johns Hopkins Univ., Baltimore, Md. Simulation of wind-speed time series for wind-energy conversion analysis [DE83-000043] p 165 N83-17026

A survey of manufacturers of solar thermal energy systems

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A survey of manufacturers of solar thermal energy systems

- West Europe report Science and technology, no 133 [JPRS-82608] p 89 N83-17757

A survey of manufacturers of solar thermal energy systems

- LPG, hydrogen Automobile fuels of tomorrow discussed p 89 N83-17758

A survey of manufacturers of solar thermal energy systems

- Fiat researchers study ceramics applications in diesels p 199 N83-17760

A survey of manufacturers of solar thermal energy systems

- West Europe report Science and technology, no 134 [JPRS-82686] p 199 N83-17761

A survey of manufacturers of solar thermal energy systems

- First results, problems of French deep gasification program p 107 N83-17765

A survey of manufacturers of solar thermal energy systems

- Pressing problems of radioecology in light of solving atomic energy problems p 36 N83-22977

A survey of manufacturers of solar thermal energy systems

- Study of psychophysiological distinctions of primates using delayed reaction test p 85 N83-26442

A survey of manufacturers of solar thermal energy systems

- JBF Scientific Corp., Wilmington, Mass. Integration of Wind Turbine Generation (WTG) into utility generating systems p 171 N83-19249

A survey of manufacturers of solar thermal energy systems

- Economics of wind energy for utilities p 116 N83-19270

A survey of manufacturers of solar thermal energy systems

- Federal applications for wind energy systems A subcontract report [DE83-000306] p 31 N83-21543

A survey of manufacturers of solar thermal energy systems

- Assessment of distributed photovoltaic electric-power systems [DE83-900531] p 75 N83-21558

A survey of manufacturers of solar thermal energy systems

- Assessment of distributed photovoltaic electric-power systems [DE83-900566] p 187 N83-22788

K**Kaman Aircraft Corp., Bloomfield, Conn.**

- Fiberglass composite blades for the 2 MW Mod-1 wind turbine generator p 170 N83-19241

Kansas State Geological Survey, Lawrence.

- Regional interpretation of Kansas aeromagnetic data [DE83-003219] p 136 N83-21701

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- Diffusion flame studies of the chemical and physical mechanisms of soot formation from aromatic and substituted aromatic fuels [DE82-009310] p 120 N83-19879

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- Assessment of the geothermal resources of Kansas Volume 2 Appendices, section 3 [DE83-003222] p 143 N83-22697

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Karlsruhe Univ. (West Germany)

Extraction of coal with solvents in liquid and supercritical state under nonhydrogenating and hydrogenating conditions
[BMFT-FB-T-82-177] p 109 N83-18032

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[NASA-CR-169797] p 88 N83-16493

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[DE82-700131] p 168 N83-18451

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[BMFT-FB-T-82-031] p 131 N83-21506

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[BMFT-FB-T-82-151-VOL-1] p 15 N83-18026

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[BMFT-FB-T-82-151-VOL-2] p 15 N83-18027

L
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Geothermal energy Opportunities for California commerce, phase 1 report
[DE82-009121] p 110 N83-18066

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[DE83-900824] p 78 N83-21614

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Perspectives in non-fuel minerals p 112 N83-18143
Energy-efficient technology Advancing US competitiveness and productivity
[GPO-98-637] p 25 N83-20371

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Design and fabrication of a prototype system for a photovoltaic residence in the Northeast
[DE82-022497] p 55 N83-16871

Solar-photovoltaic power for broadcasting stations An economic analysis
[DE82-022498] p 55 N83-16873

Innovative photovoltaic application for residences experiment
[DE83-000399] p 57 N83-16898

Photovoltaic/thermal collector development program
[DE82-012572] p 71 N83-20416

Photovoltaic 1-5 curve measurement techniques
[DE83-000447] p 80 N83-22534

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[BMFT-FB-T-82-018] p 131 N83-21505

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[PB82-262577] p 96 N83-16461

An overview of large wind turbine tests by electric utilities p 172 N83-19265

Lockheed Missiles and Space Co., Sunnyvale, Calif.

Lightweight solar array blanket tooling, laser welding and cover process technology
[NASA-CR-170209] p 81 N83-22741

Los Alamos Scientific Lab., N. Mex.

Long titanium heat pipes for high-temperature space radiators p 185 N83-27127

Uranium hydrogeochemical and stream sediment reconnaissance of the St. Michael NTMS quadrangle, Alaska
[DE82-009999] p 99 N83-16844

Annual thermal performance of sunspace-type passive-solar collectors for residence heating Attached and semi-enclosed geometries
[DE83-002310] p 56 N83-16888

Energy optimization in DOD facilities
[DE82-008108] p 7 N83-16925

Penetration for four solar technologies in electric utilities and the environmental benefits
[DE82-010864] p 59 N83-16927

Penetration and air-emission-reduction benefits of solar technologies in the electric utilities
[DE82-002637] p 9 N83-16971

Lithology and hydrothermal alteration determination from well logs for the Cerro Prieto Wells, Mexico
[DE82-004677] p 101 N83-17000

Relationship between pyrite formation and organic sulfur content of coal as revealed by electron microscopy
[DE82-010417] p 104 N83-17652

Methane hydrate gas production An assessment of conventional production technology as applied to hydrate gas recovery
[DE82-006746] p 107 N83-17742

Recovery of minerals from US coals
[DE82-008173] p 108 N83-18010

Fractionation of an oil shale retort process water Isolation of photoactive genotoxic components
[DE82-010428] p 108 N83-18014

A data-gathering method for use in modeling energy research, development and demonstration programs
[DE82-006153] p 16 N83-18040

The promise and status of international applications of photovoltaics
[DE82-006152] p 16 N83-18042

Solar-absorber-selective paint research
[DE82-006104] p 61 N83-18050

Energy development on Native American lands Resources and attitudes An interpretive report on two major Indian conferences of 1980
[DE82-009539] p 17 N83-18076

Energy supply and demand in the Caribbean region, 1978-2000
[DE82-002312] p 18 N83-18080

Proceedings of the Workshop on Radioactivity Associated with Coal Gas
[DE82-007880] p 18 N83-18100

Utilization of the catalyzed-DD fuel cycle in Reversed-Field Pinch Reactors (RFPRs)
[DE82-010425] p 168 N83-18512

Impact of flywheel-energy-storage technology upon taxicab fleet operation in a large metropolitan city
[DE82-002371] p 194 N83-18591

Uranium hydrogeochemical and stream sediment reconnaissance of the Barter Island NTMS quadrangle, Alaska
[DE82-009666] p 115 N83-19196

Uranium hydrogeochemical and stream sediment reconnaissance of the Tanacross NTMS quadrangle, Alaska
[DE82-009664] p 115 N83-19197

National implications of solar futures A TASE project report
[DE82-005122] p 64 N83-19281

Potential biological hazards of nickel arsenides associated with retorting of oil shale Toxic effects of particulate Ni5As2
[DE82-010978] p 22 N83-19328

The application of DOE-2 in the predesign phase of commercial-building design
[DE82-014067] p 31 N83-21201

Geothermal data for 95 thermal and nonthermal waters of the Valles Caldera, southern Jemez Mountains region, New Mexico
[DE82-017397] p 130 N83-21496

Feasibility evaluation of fuel cells for selected heavy-duty transportation systems
[DE83-002953] p 179 N83-21550

Use of hot-dry-rock geothermal resources for space heating A case study
[DE83-002947] p 135 N83-21636

Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703

User's manual for HDR3 computer code
[DE83-003993] p 136 N83-21828

Catalytic coal conversion support Use of laser flash-pyrolysis for structural analysis
[DE82-014124] p 139 N83-22366

Recovery of gas from hydrate deposits using conventional production technology
[DE82-008106] p 145 N83-22775

Role of water in energy development
[DE82-011986] p 35 N83-22800

The Light Weight Radioisotope Heater Unit (LWRHU) A technical description of the reference design
[DE82-014121] p 148 N83-23138

Reentry thermal testing of a general purpose heat source fueled clad
[DE82-014125] p 184 N83-23146

Reentry thermal testing of light-weight radioisotope heater unit
[DE82-014116] p 148 N83-23147

Louisiana State Univ., Baton Rouge.

The effects of weather systems, currents and coastal processes on major oil spills at sea
[AD-A120221] p 8 N83-16953

Use of twin wells and water-source heat pumps for energy conservation in Louisiana
[DE83-900349] p 32 N83-21610

Lufthansa German Airlines, Cologne (West Germany). Slideslip indication system p 12 N83-17466

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Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703

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Design strategy for the combustion of coal-derived liquid fuels
[DE82-905496] p 95 N83-16444

The energy transition and the macroeconomy A framework for policy analysis
[DE82-007839] p 16 N83-18039

Data report for the Northeast Residential Experiment Station, October 1981
[DE82-007648] p 61 N83-18044

Estimating pollutant exposures from coal fired power plants in a rural region
[DE82-008136] p 19 N83-18109

ASPEN technical reference manual
[DE82-020201] p 112 N83-18325

ASPEN technical reference manual
[DE82-020200] p 112 N83-18326

ASPEN system administrator manual
[DE82-202199] p 112 N83-18327

ASPEN system administrator manual
[DE82-020198] p 113 N83-18328

ASPEN user manual
[DE82-020196] p 113 N83-18329

Coal pyrolysis by hot solids from a fluidized-bed combustor
[DE83-003344] p 117 N83-19829

Graded-index antireflective coatings for glass
[DE82-016756] p 67 N83-19917

Chalcogenide-glass solar cells
[DE82-021243] p 68 N83-20382

Stability analysis of flexible wind turbine blades using finite element method
[NASA-CR-168107] p 177 N83-21508

Simplified aerodynamic modeling of horizontal axis wind turbines
[NASA-CR-168109] p 178 N83-21509

Performance characteristics and design criteria for the thermic diode, a passive thermosyphon solar heating system
[DE82-012455] p 78 N83-21604

Coal-gasification and tar-conversion reactions over calcium oxide
[DE82-014635] p 139 N83-22358

Computer-aided industrial process design The ASPEN project
[DE82-014469] p 181 N83-22484

Some experiments on yaw stability of wind turbines with various coning angles
[NASA-CR-168108] p 181 N83-22740

Development of methodology for horizontal axis wind turbine dynamic analysis
[NASA-CR-168110] p 181 N83-22747

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Low-temperature pyrolysis of coal to produce diesel-fuel blends
[DE83-001637] p 126 N83-21076

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Geotechnical basis for underground energy storage in hard rock
[DE82-903307] p 198 N83-22836

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Optical measurements p 66 N83-19567

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Solar-collector materials exposure to the IPH site environment Task 50
[DE83-002192] p 62 N83-18072

Receiver subsystem analysis report (RADL Item 4-1) The 10-MWe solar thermal central-receiver pilot plant
[DE83-001638] p 65 N83-19295

Solar-facilities design integration Plant operating/training manual (RADL-Item 2-36)
[DE83-001670] p 75 N83-21551

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Power factor controllers p 80 N83-22510

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Development of standards and a cost model for coal agglomeration and related studies
[DE82-011047] p 105 N83-17678

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Rankine/Rankine cycle gas-fired heat pump
[PB82-254640] p 165 N83-16944

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Maintaining automotive mobility: Using fuel economy and synthetic fuels to compete with OPEC oil
[DE83-004873] p 37 N83-23245

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Force inductions in helicopter rotor blades, wind channel fans and wind turbines
[M8B-UD-356-82-O] p 166 N83-17522

Michigan State Univ., East Lansing.

Wind and turbine characteristics needed for integration of wind turbine arrays into a utility system
p 171 N83-19247

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Lightweight aircraft engines, the potential and problems for use of automotive fuels
p 141 N83-22446

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Wisconsin collector-efficiency study, phase two
[DE82-013425] p 71 N83-20426

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Preliminary design study of compressed-air energy storage in a salt dome Volume 6 CAES plant design
[DE82-014355] p 196 N83-21580

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Influence of grain boundaries on solar cell performance
[DE82-004662] p 56 N83-16881

Wind system value analysis for electric utilities A comparison of four methods
[DE82-006963] p 164 N83-16883

Organic rankine cycle coupled to a solar pond by direct-contact heat exchange - selection of a working fluid
[DE82-020998] p 57 N83-16900

Terrestrial solar spectral data sets
[DE83-000504] p 60 N83-17001

Stability of reflectors with polymeric coatings
[DE82-007774] p 60 N83-17723

Comparison of heat pump water heaters and solar domestic water heaters
[DE82-006117] p 61 N83-18046

Effects of grain boundaries in GaAs solar cells
[DE82-006118] p 61 N83-18059

The energy of the ocean thermal resource and the second-law efficiency of idealized ocean thermal energy conversion power cycles
[DE83-000449] p 167 N83-18071

Entrained flow, ablative fast pyrolysis of biomass
[DE82-005791] p 113 N83-18875

Open-cycle systems performance analysis programming guide
[DE82-005696] p 174 N83-19282

The utilization of emergent aquatic plants for biomass-energy-systems development
[DE82-009174] p 124 N83-20395

Performance and stability of the mist-lift process for open-cycle OTEC
[DE82-010881] p 175 N83-20403

Flow instability during direct steam generation in a line-focus solar-collector system
[DE82-012887] p 70 N83-20404

Solar electric technologies Methods of electric utility value analysis
[DE82-014285] p 71 N83-20409

Photobiology task of the advanced solar energy research program
[DE82-012310] p 71 N83-20417

Devising efficient biotechnological processes for the production of fuels and chemicals from biomass
[DE82-017089] p 124 N83-20418

Reformed methanol
[DE83-002096] p 129 N83-21176

Steam generation in line-focus solar collectors A comparative assessment of thermal performance, operating stability and cost issues
[DE82-014531] p 76 N83-21568

Energy-conserving and passive-solar construction details
[DE82-014467] p 76 N83-21569

Electric-utility value determination for wind energy Volume 2 A user's guide
[DE82-010926] p 134 N83-21596

The acquisition of wind rights for wind energy development
[DE82-009139] p 32 N83-21597

Design approaches for solar industrial process-heat systems Nontracking and line-focus collector technologies
[DE83-003339] p 79 N83-21620

Photovoltaic advanced research and development program in the United States
[DE83-000307] p 83 N83-22814

Advanced silicon-sheet-growth techniques
[DE82-017088] p 84 N83-22831

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Brazilian energy model
[DE82-902461] p 26 N83-20378

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[DE82-902329] p 6 N83-16902

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Development and implementation of dynamic methodologies for evaluating energy conservation strategies
[PB82-240763] p 21 N83-19304

Development and implementation of dynamic methodologies for evaluating energy conservation strategies Executive summary
[PB82-240771] p 21 N83-19305

Design of plywood and paper flywheel rotors
[DE83-002276] p 195 N83-20430

Fundamental heat-transfer processes related to phase-change thermal-storage media
[DE83-002205] p 196 N83-21639

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Alternative engine fuels Educational demonstration project
[DE83-004579] p 141 N83-22462

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Electrical overvoltage failure in silicon solar cells
[DE83-004475] p 80 N83-21637

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National implications of solar futures A TASE project report
[DE82-005122] p 64 N83-19281

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National implications of high solar and biomass energy growth A technology assessment of solar energy systems The TASE Project
[DE83-004935] p 34 N83-21638

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Large area silicon sheet by EFG
[NASA-CR-169920] p 63 N83-19219

Stress studies in EFG
[NASA-CR-170205] p 81 N83-22745

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Oil/refuse homogenization An approach to combustion of refuse in existing oil-fired boilers
[DE82-011848] p 138 N83-22353

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Catalytic hydrogenation of coal-derived liquids
[DE83-003582] p 126 N83-21068

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Mass balance results for the Pricetown 1 underground goal gasification field test
[DE82-005667] p 162 N83-16556

Tritium transport and control in the FED
[DE82-002592] p 168 N83-18511

Mueller Associates, Inc., Baltimore, Md.

Design and fabrication of a prototype system for a photovoltaic residence in the Northeast
[DE82-022497] p 55 N83-16871

Thermal performance case studies for residential solar heating and cooling systems
[PB82-260100] p 59 N83-16940

Safe handling and testing of alternative fuels
[DE82-009176] p 89 N83-21183

Murray and Trettel, Inc., Northfield, Ill.

The useful potential of using existing data to uniquely identify predictable wind events and regimes, part 1
p 116 N83-19250

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[DE82-008853] p 198 N83-22837

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Technologies for Measurement While Drilling
[PB82-243858] p 114 N83-18964

A comparison of alternative energy storage systems for automobiles
[PB82-249954] p 174 N83-19309

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Meeting the challenge of climate
[PB83-106443] p 29 N83-20511

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[DE83-002771] p 33 N83-21619

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The NASA program in Space Energy Conversion Research and Technology
p 160 N83-27326

Association-solvation characteristic of fuels and lubricating and hydraulic oils
[NASA-TM-76957] p 96 N83-16525

Construction, testing and development of large wind energy facilities
[NASA-TM-76933] p 163 N83-16855

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Development of High Frequency Electromagnetic Mapping (HFEM) technology
[DE82-012773] p 122 N83-19998

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[PB82-260456] p 165 N83-16938

Physical properties data compilations relevant to energy storage Part 5 Mechanical properties data on alloys for use in flywheels
[PB82-232919] p 194 N83-18904

Solar energy systems Standards for screening plastic containment materials
[PB82-242454] p 62 N83-18921

Strategies for energy conservation in small office buildings
[PB82-245820] p 22 N83-19306

An evaluation of hydrated calcium aluminate compounds as energy storage media
[PB82-249921] p 194 N83-19308

Oil and Gas Supply Modeling
[PB82-234139] p 117 N83-19310

Outdoor exposure tests of solar absorptive coatings
[PB83-124560] p 84 N83-22840

Hail impact testing procedure for solar collector covers
[PB83-104745] p 84 N83-22841

Performance criteria for solar heating and cooling systems in residential buildings
[PB83-122663] p 85 N83-22843

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Propanol-plus as extender to diesel fuel
[CSIR-ME-445] p 128 N83-21165

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[CSIR-ME-446] p 129 N83-21166

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[PB82-258047] p 165 N83-16941

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[PB82-255084] p 10 N83-16985

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[PB83-112433] p 29 N83-20525

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Workshop on the Federal Role in the Commercialization of Large Scale Windmill Technology (summary and papers)
[PB83-105593] p 28 N83-20438

Workshop on the Federal Role in Synfuels Development
[PB83-102236] p 30 N83-21187

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[PB82-246752] p 22 N83-19307

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[PB83-121533] p 200 N83-22480

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[DE82-016128] p 180 N83-21602

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Mine personnel locator and mine activity controller
[PB82-235979] p 200 N83-19315

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SHEBMS Small Hydroelectric Basin Modeling System
[DE82-015411] p 183 N83-22832

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Leachate-treatment technique utilizing fly ash as low-cost sorbent
[DE82-010501] p 111 N83-18101

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Energy resources in New Mexico Oil and gas, coal, electrical generation, uranium, and geothermal energy
[DE83-900485] p 142 N83-22672

Role of energy resources in New Mexico
p 34 N83-22673

Oil and gas
p 34 N83-22674

Coal
p 143 N83-22675

Electrical generation
p 143 N83-22676

Uranium
p 143 N83-22677

- Geothermal p 143 N83-22678
- New Mexico State Univ., Las Cruces.**
- Solar thermochemical energy conversion and transport [AD-A121318] p 64 N83-19276
- New Mexico Univ., Albuquerque.**
- Potential for domestic heat recovery [DE82-901395] p 15 N83-18037
- New York State Energy Research and Development Authority, New York.**
- Peat-resource estimation in New York State [DE82-005156] p 108 N83-18007
- New York State Univ., Binghamton.**
- Desulfurization with transition-metal catalysis [DE82-013964] p 118 N83-19853
- New York Univ., New York.**
- World oil model development [DE82-013979] p 25 N83-20334
- New Zealand Energy Research and Development Committee, Auckland.**
- Present and potential use of micro-hydroelectric schemes in remote locations [DE82-904687] p 26 N83-20411
- Small hydro-electric potential West Poverty Bay region [DE82-905090] p 26 N83-20412
- North Carolina Agricultural and Technical State Univ., Greensboro.**
- Renewable energy system feasibility study [AD-A121252] p 15 N83-18035
- North Carolina State Univ., Raleigh.**
- Rates and equilibria of devolatilization and trace element evolution in coal pyrolysis [PB82-260944] p 96 N83-16460
- First year's performance data of the NCSU solar energy and conservation house [DE83-004800] p 83 N83-22808
- Northeastern Forest Experiment Station, Broomall, Pa.**
- Converting small industrial boilers to burn wood fuels [PB83-128116] p 147 N83-22844
- Northwest Airlines, Inc., Minneapolis, Minn.**
- Fuel conservation techniques in jet transport aircraft operations p 12 N83-17463
- Notre Dame Univ., Ind.**
- Energy conservation in electrostatic fabric filtration of industrial dust [DE82-006897] p 15 N83-18036
- National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.**
- Corrosion of 310 stainless steel in H₂-H₂O-H₂S gas mixtures Studies at constant temperature and fixed oxygen potential p 90 A83-20265
- National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.**
- Comparative values of advanced space solar cells [NASA-TM-84951] p 60 N83-18023
- ERRSAC contributions to the search for Appalachian hydrocarbons p 114 N83-19155
- National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.**
- Systems and operations - Living with complexity and growth p 86 A83-24357
- Structures and mechanisms - Streamlining for fuel economy p 2 A83-24361
- Using a global hydrogen-air combustion model in turbulent reacting flow calculations p 86 A83-24667
- Semiconductor photoelectrochemistry [NASA-TP-2088] p 167 N83-18024
- Chalcogenophosphate photoelectrodes [NASA-CASE-LAR-12958-1] p 60 N83-18025
- Design, fabrication and test of liquid metal heat-pipe sandwich panels [NASA-TM-84631] p 187 N83-22541
- National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio**
- Cross-linked polyvinyl alcohol films as alkaline battery separators p 149 A83-20576
- Catalytic combustion with steam injection [ASME PAPER 82-JPGC-GT-23] p 93 A83-25271
- Solar array switching power management p 45 A83-27132
- A new strategy for efficient solar energy conversion - Parallel-processing with surface plasmons p 46 A83-27140
- Design flexibility of redox flow systems p 189 A83-27177
- Pore size engineering applied to starved electrochemical cells and batteries p 154 A83-27201
- Performance degradation and cleaning of photovoltaic arrays p 48 A83-27236
- Improved Stirling engine performance using jet impingement p 158 A83-27288
- Construction of low-cost, Mod-OA wood composite wind turbine blades [NASA-TM-83046] p 163 N83-16857

- Computer program for Stirling engine performance calculations [NASA-TM-82960] p 166 N83-17423
- Evaluation of production version of the NASA improved inorganic-organic separator [NASA-TM-83018] p 166 N83-18022
- Large Horizontal-Axis Wind Turbines [NASA-CP-2230] p 169 N83-19231
- The response of a 38m horizontal axis teetered rotor to yaw p 169 N83-19232
- Fixed pitch rotor performance of large horizontal axis wind turbines p 169 N83-19233
- Stall induced instability of a teetered rotor p 169 N83-19234
- Free yaw performance of the Mod-0 large horizontal axis 100 kW wind turbine p 170 N83-19235
- Structural fatigue test results for large wind turbine blade sections p 170 N83-19246
- Performance and load data from Mod-OA and Mod-1 wind turbine generators p 171 N83-19255
- Operating experience with four 200 kW Mod-OA wind turbine generators p 171 N83-19256
- Experience and assessment of the DOE/NASA Mod-1 2000 kW wind turbine generator at Boone, North Carolina p 172 N83-19257
- Mod-2 wind turbine project assessment and cluster test plans p 172 N83-19262
- Heat pipes containing alkali metal working fluid [NASA-CASE-LEW-12253-1] p 186 N83-19596
- Implementation of R & QA practices in Research and Development programs [NASA-TM-82997] p 24 N83-19651
- High performance liquid chromatographic hydrocarbon group-type analyses of mid-distillates employing fuel-derived fractions as standards [NASA-TM-83072] p 120 N83-19920
- Critical research and advanced technology (CRT) support project [NASA-TM-83019] p 123 N83-20361
- Screen printed interdigitated back contact solar cell [NASA-CASE-LEW-13414-1] p 68 N83-20374
- Aviation Gasolines and Future Alternatives [NASA-CP-2267] p 140 N83-22442
- Industry's assessment of the number of airplanes in the general aviation fleet along with their hours flown and fuel consumption data powered by what type of engines, when and for what reasons, through the year 2000 p 140 N83-22445
- Fuel supply and distribution Fixed base operation p 141 N83-22449
- Tests of an alternating current propulsion subsystem for electric vehicles on a road load simulator [NASA-TM-83036] p 182 N83-22749
- National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.**
- Thermal control - Heat buses will operate like a public utility p 184 A83-24358
- Optimization technique for improved microwave transmission from multi-solar power satellites p 185 A83-27152
- National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.**
- Electric power - Looking at regenerative systems p 43 A83-24353
- Improved thermophotovoltaic power system p 46 A83-27139
- Cassegrainian concentrator solar array exploratory development module p 49 A83-27250
- National Aeronautics and Space Administration. Pasadena Office, Calif.**
- Combustion engine system [NASA-CASE-NPO-14565-2] p 89 N83-19826
- High production shuttle car system for coal mines [NASA-CASE-NPO-15949-1] p 187 N83-20155
- Oak Ridge National Lab., Tenn.**
- Dynamic modeling and control analysis of froth flotation and clean-coal filtration as applied to coal beneficiation [DE82-004555] p 97 N83-16558
- Sasol The commercial experience An executive summary [DE82-011304] p 98 N83-16572
- Electric system impacts of storage heating and storage water heating, part 2 [DE81-032010] p 192 N83-16863
- Physical chemistry of molten-salt batteries Current-induced composition gradients in molten LiCl-KCl [DE83-001684] p 192 N83-16875
- Using peat for energy: Potential environmental restraints Overview p 5 N83-16876

- Hydraulic air compressor for ocean thermal energy conversion applications [DE82-005198] p 163 N83-16880
- Energy audits at 48 hospitals [DE82-002814] p 5 N83-16884
- Analysis of energy use at US institutional buildings [DE82-004670] p 6 N83-16886
- Health and safety issues of alternate energy systems [DE82-002918] p 9 N83-16959
- The implications of a stochastic approach to air-quality regulations [DE83-001636] p 9 N83-16972
- Environmetrics of synfuels Part 4 Project Results Tracking System (PRTS) [DE82-011444] p 10 N83-16977
- Development of statistical databases for toxicological studies [DE82-005196] p 10 N83-17067
- Experimental techniques for the study of photosynthetic water splitting [DE82-003974] p 89 N83-17668
- Results of u-bend stress-corrosion-cracking specimen exposures in coal-liquefaction pilot plants [DE82-012889] p 105 N83-17708
- Economic incentives for additional critical experimentation applicable to fuel dissolution [DE82-006818] p 106 N83-17737
- Steam ejector as an industrial heat pump [DE82-010194] p 14 N83-17847
- Metal recovery from eastern oil shale [DE82-004052] p 109 N83-18016
- Investigation of attic-insulation effectiveness using actual energy-consumption data [DE82-006822] p 17 N83-18055
- Application of laser annealing and laser-induced diffusion to photovoltaic conversion [DE82-006792] p 61 N83-18056
- Startup experience with a concentrating photovoltaic power system [DE82-008833] p 62 N83-18069
- Evaluation of the mathematical and economic basis for conversion processes in the LEAP energy-economy model [DE83-001706] p 167 N83-18079
- Fossil energy program [DE82-007496] p 111 N83-18082
- Fossil-energy program [DE82-007502] p 111 N83-18083
- Advanced research and technology development fossil energy materials program [DE82-007121] p 111 N83-18085
- Statistical database management for ecosystem-effects analysis [DE82-005199] p 18 N83-18104
- A review of utility issues for the integration of wind electric generators p 173 N83-19269
- National implications of solar futures A TASE project report [DE82-005122] p 64 N83-19281
- Analysis of environmental issues related to small-scale hydroelectric development 6 Dissolved oxygen concentrations below operating dams [DE82-007127] p 22 N83-19329
- Publications in life sciences synthetic fuels of Oak Ridge National Laboratory [DE83-001701] p 122 N83-19945
- Conceptual design and performance analysis of absorption heat pumps for waste-heat utilization [DE82-010202] p 186 N83-20060
- Annual cycle energy system performance and national economic companions with competitive residential HVAC systems [DE82-010188] p 68 N83-20377
- District heating and more-efficient buildings [DE81-025437] p 26 N83-20379
- Potential benefits of R and D directed toward increasing the cost-effectiveness of energy use [DE83-013435] p 27 N83-20423
- Energy-data validation An overview and some concepts [DE82-020901] p 27 N83-20431
- New physical-chemical reactions useful for TES [DE82-020807] p 195 N83-20432
- Magnesia spray absorption for the removal of SO₂ from flue gas [DE82-013443] p 28 N83-20456
- Electromigrational composition gradients in molten carbonates A review [DE83-002593] p 177 N83-21075
- Engineering systems analysis of pressurized fluidized-combustion power systems [DE82-013390] p 127 N83-21083
- Selecting and testing oxygen-measuring systems for fluidized-bed combustors [DE83-005987] p 128 N83-21089

- Evaluation of Mississippi County Community College and Northwest Mississippi Junior College solar power systems [DE83-004239] p 73 N83-21518
- Fossil energy materials program plan for fiscal years 1982 through 1986 [DE83-004237] p 131 N83-21519
- Use of vegetation to ameliorate building microclimates. An assessment of energy-conservation potentials [DE82-013255] p 32 N83-21572
- Adiabatic absorption and desorption for improvement of temperature-boosting adsorption heat pumps [DE83-002589] p 33 N83-21611
- Performance and economics of residential solar space heating [DE83-003187] p 79 N83-21626
- Performance and economics of 8 alternative systems for residential heating, cooling, and water heating in 115 US cities [DE83-003196] p 33 N83-21630
- Coal-liquefaction-plant fractionation-column corrosion-coupon studies [DE82-007469] p 139 N83-22360
- Thermal-convection-loop study of the corrosion of Fe-Ni-Cr alloys by molten NaNO₃/sub 3-KNO₃/sub 3 [DE83-004228] p 80 N83-22407
- Cartographic evaluation of environmental-management strategies [DE82-009828] p 35 N83-22702
- Heat-activated heat-pump development and potential application of Stirling-engine technology [DE83-002134] p 183 N83-22817
- Investigation of attic insulation effectiveness using actual energy consumption data [DE83-000225] p 36 N83-22828
- Offshore Power Systems, Jacksonville, Fla.**
- Conceptual design study Standard Floating Nuclear Power Plant on inshore site and Modified Floating Nuclear Power plant on upriver site [DE82-007916] p 174 N83-19595
- Ohio State Univ., Columbus.**
- Salt gradient solar pond development [DE82-020630] p 58 N83-16916
- Oklahoma Univ., Norman.**
- Development of a thermodynamic properties correlation framework for the coal conversion industry, phase 2 [DE82-009866] p 148 N83-23190
- Old Dominion Univ., Norfolk, Va.**
- Theoretical studies of solar-pumped lasers [NASA-CR-169890] p 60 N83-17871
- Olin Corp., Stamford, Conn.**
- Manufacture, distribution, and handling of nitrate salts for solar-thermal applications [DE83-003317] p 79 N83-21625
- Opportunity Systems, Inc., Washington, D C**
- State of California Resource-recovery profile [DE83-004949] p 146 N83-22812
- Oregon Inst. of Tech., Klamath Falls.**
- Geothermal heating facilities for Frontier Inn, Susanville, California [DE82-015114] p 134 N83-21590
- Geothermal greenhouse heating facilities for the Klamath County Nursing Home, Klamath Falls, Oregon [DE82-015104] p 134 N83-21592
- Distinct-heating system, La Grande, Oregon [DE82-015102] p 32 N83-21593
- Utilization of warm well water, eastern Washington state [DE82-015101] p 134 N83-21594
- Geothermal-heating facilities for Carson Elementary School and Wind River Middle School [DE82-015121] p 134 N83-21595
- Oregon State Univ., Corvallis.**
- Atmospheric turbulence parameters for modeling wind turbine dynamics [DE83-002976] p 122 N83-20171
- Effect of low-proof alcohol fumigation-fueling on crankcase oil dilution in a diesel-cycle engine [DE83-002976] p 122 N83-20171
- DAO Corp., Greenbelt, Md.**
- The non-Federal oceanographic community. An overview [NASA-CR-169802] p 102 N83-17414
- Pacific Gas and Electric Co., San Francisco, Calif.**
- Development of the utilization of combustible gas produced in existing sanitary landfills. Effects of corrosion at the Mountain View, California landfill gas-recovery plant [DE83-001576] p 145 N83-22769
- Pacific Northwest Lab., Richland, Wash.**
- Steam gasification of wood in the presence of catalysts [DE82-005919] p 162 N83-16557

- Isolation of metallic complexes in shale oil and shale oil retort waters [DE82-005931] p 98 N83-16835
- User manual for GEOCITY. A computer model for cost analysis of geothermal district-heating-and-cooling systems. Volume 1. Main text [DE82-022512] p 99 N83-16865
- User manual for GEOCITY. A computer model for cost analysis of geothermal district-heating-and-cooling systems. Volume 2. Appendices [DE82-022511] p 99 N83-16866
- Collection, transportation, and storage of biomass residues in the Pacific Northwest [DE82-004737] p 100 N83-16887
- Bench scale research in biomass direct liquefaction [DE82-005228] p 100 N83-16905
- Guidelines for sampling and analyzing solutions for aquifer thermal-energy-storage systems [DE83-001852] p 10 N83-16973
- The Wind Characteristics Program [DE82-005226] p 101 N83-17023
- World-wide resource assessment [DE82-004272] p 102 N83-17024
- Simulation of wind-speed time series for wind-energy conversion analysis [DE83-000043] p 165 N83-17026
- Candidate wind-turbine-generator site summarized meteorological data for the period December 1976 through December 1981 [DE83-000884] p 102 N83-17028
- Methanol synthesis gas from catalytic steam reforming of wood [DE82-006082] p 106 N83-17734
- Design of highwall mining equipment electronic guidance package [DE82-006115] p 108 N83-18005
- Western oil shale development. A technology assessment. Volume 8. Health effects of oil shale development [DE82-006895] p 109 N83-18015
- Cost of heat from a seasonal source [DE82-006026] p 194 N83-18045
- Pacific Northwest biomass as an energy resource [DE82-005804] p 110 N83-18047
- Hybrid solar-wind energy conversion systems meteorological aspects [DE82-005798] p 61 N83-18053
- New priorities in energy-conservation research and development [DE82-005988] p 16 N83-18054
- Catalyst behavior in biomass gasification [DE82-006164] p 110 N83-18057
- Catalytic gasification of biomass [DE82-005877] p 110 N83-18058
- Commercial building design and energy conservation. A preliminary assessment [DE82-008581] p 17 N83-18067
- Optical properties of sputtered Si H [DE82-007072] p 62 N83-18491
- Putting wind resource atlases to use [DE82-005988] p 115 N83-19237
- Approaches to wind resource verification [DE82-005988] p 116 N83-19238
- Assessing the representativeness of wind data for wind turbine site evaluation [DE82-005988] p 116 N83-19239
- Wind turbine siting. A summary of the state of the art [DE82-005988] p 116 N83-19240
- Long-term energy capture and the effects of optimizing wind turbine operating strategies [DE82-005988] p 171 N83-19248
- Inherent uncertainties in meteorological parameters for wind turbine design [DE82-005988] p 171 N83-19253
- Potential errors in using one anemometer to characterize the wind power over an entire rotor disk [DE82-005988] p 171 N83-19254
- National implications of solar futures. A TASE project report [DE82-005122] p 64 N83-19281
- Overview of existing residential energy-efficiency rating systems and measuring tools [DE83-003148] p 20 N83-19289
- Meteorological field measurements at potential and actual wind-turbine sites [DE83-001493] p 174 N83-19398
- Combustion of oil on water. An experimental program [DE82-014596] p 127 N83-21084
- Real time sensors in geothermal fluids, their costs and benefits [DE82-014857] p 130 N83-21328
- CAESCAP. A computer code for compressed-air energy-storage-plant cycle analysis [DE83-003146] p 196 N83-21528
- Coastal zone wind energy. Part 3. A procedure to determine the wind power potential of the coastal zone [DE82-014334] p 134 N83-21598

- The wake of the MOD-OA1 wind turbine at two rotor diameters downwind on December 3, 1981 [DE83-003305] p 180 N83-21622
- Evaluation of ammonia as a working fluid for a wet/dry-cooled binary geothermal plant [DE83-002895] p 135 N83-21631
- Comparison of model and observations of the wake of a MOD-OA wind turbine [DE83-002882] p 180 N83-21633
- Analytical modeling of a hydraulically-compensated compressed-air energy-storage system [DE83-005708] p 197 N83-21640
- Geotechnical properties of PARAHO spent shale [DE83-002633] p 136 N83-21694
- Vertical extrapolations of wind speed [DE83-000944] p 136 N83-21723
- Issues affecting storage of compressed air in solution-mined salt cavities [DE83-002017] p 197 N83-22804
- Aquifer compressed-air field experiment at Pittsfield, Illinois [DE83-002057] p 198 N83-22805
- Underground energy-storage program overview [DE83-002059] p 198 N83-22806
- Parsons (Ralph M.) Co., Pasadena, Calif.**
- Process engineering and mechanical design reports. Volume 1. Preliminary design and assessment of a 50,000 BPD coal-to-methanol-to-gasoline plant [DE83-000848] p 97 N83-16559
- Peat, Marwick, Mitchell and Co., San Francisco, Calif.**
- Aircraft towing feasibility study p 11 N83-17458
- Pennsylvania State Univ., University Park.**
- Spectra over complex terrain in the surface layer [DE83-000502] p 102 N83-17027
- Relationships between coal constitution, thermoplastic properties and liquefaction behavior of coals and vitrinite concentrates from the lower Kittanning seam, part 1 [DE82-012848] p 118 N83-19860
- The relevance of coal geochemistry to coal utilization p 144 N83-22767
- Pennsylvania Univ., Philadelphia.**
- Instrumental methods of analysis of sulfur compounds in synfuel process streams [DE82-011559] p 95 N83-16446
- Perkin-Elmer Corp., Norwalk, Conn.**
- Polycrystalline solar cell/substrate growth by integrated vacuum evaporation [DE82-017203] p 58 N83-16917
- Phillips Petroleum Co., Bartlesville, Okla.**
- Manufacturing comparisons of aviation and motor gasolines p 141 N83-22448
- Photowatt International, Inc., Tempe, Ariz.**
- Development of technique for air coating and nickel and copper metallization of solar cells [NASA-CR-169938] p 63 N83-19222
- Physical Sciences, Inc., Andover, Mass.**
- Systems analysis of on-site integrated energy systems, phase 1 [DE83-000044] p 179 N83-21549
- Physical Sciences, Inc., Woburn, Mass.**
- Hot-gas cleanup for molten-carbonate fuel cells [DE82-002500] p 163 N83-16864
- Pinson Energy Corp., Marston Mills, Mass.**
- ASI/Pinson 1-kilowatt high-reliability wind system development. Phase 1. Design and analysis [DE82-016128] p 180 N83-21602
- Pittsburgh and Midway Coal Mining Co., Englewood, Colo.**
- Solvent-Refined-Coal (SRC) Process. Coking of SRC-2 process streams. Part 3. Effects of coal minerals on coking. Part 4. Thermal properties of SRC-2 cokes and process streams [DE82-012369] p 104 N83-17657
- Solvent-Refined-Coal (SRC) process [DE82-010061] p 107 N83-17743
- Pope, Evans, and Robbins, Inc., New York**
- Congeneration feasibility. Otis Elevator Company and Polychrome Corporation [PB82-263526] p 7 N83-16942
- Power Math Associates, Inc., Tempe, Ariz.**
- Security assessment of power systems including energy storage and with the integration of wind energy. Volume 1. Digital transient simulation effort consulting agreement number 1 [DE82-021063] p 164 N83-16915
- Price and Partners, Takoma Park, Md.**
- Design and fabrication of a prototype system for a photovoltaic residence in the Northeast [DE82-022497] p 55 N83-16871
- Princeton Univ., N. J.**
- The stellerator approach to toroidal plasma confinement [DE82-005727] p 165 N83-17325
- General aviation airplane fuel economy system model p 20 N83-18647

The plasmadynamics and ionization kinetics of thermionic energy conversion
[DE82-012938] p 176 N83-20421

Pritchard Corp., Kansas City, Mo.

Underground Coal Gasification (UCG) gas to methanol and MTG-gasoline. An economic and sensitivity study, task B
[DE83-004320] p 146 N83-22821

Process Plants, Inc., Houston, Tex.

The engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc. at Thibodaux, Louisiana. Attachment A. Volume 2. Definition of facilities and scope of work for an ethanol facility to be located at Thibodaux, Louisiana
[DE83-001165] p 147 N83-22829

Public Service Co. of Indiana, Plainfield.

Compressed-air energy storage preliminary design and site development program in an aquifer. Volume 3, part 1. Site Selection study
[DE82-001251] p 192 N83-16869

Compressed-air energy storage preliminary design and site development program in an aquifer. Volume 3. Site-selection study, part 2
[DE83-001252] p 194 N83-18074

Compressed-air energy storage preliminary design and site development program in an aquifer. Volume 5, part 2, appendix F. Dynamic system computer model
[DE83-004004] p 197 N83-22758

Compressed-air energy storage preliminary design and site development program in an aquifer. Volume 5, Part 1. Turbomachinery design
[DE83-004005] p 197 N83-22759

Public Service Electric and Gas Co., Newark, N. J.

Electric system impacts of storage heating and storage water heating, part 2
[DE81-032010] p 192 N83-16863

Purdue Univ., Lafayette, Ind.

Energy Conservation in Historic Structures. An information/awareness bulletin
[DE82-005212] p 6 N83-16903

Flash photoelectrochemical studies of transient electrode processes important in solar-energy conversion
[DE83-003134] p 76 N83-21560

R**R and D Associates, Arlington, Va.**

Research needs. Prime-power for high energy space systems
[AD-A120209] p 163 N83-16861

Radian Corp., Austin, Tex.

Evaluation of the maintenance effect on fugitive emissions from refineries in the south coast air quality management district
[PB82-239260] p 23 N83-19356

Acid rain mitigation study. Volume 1. FGD cost estimates
[PB83-101329] p 29 N83-20459

Acid rain mitigation study. Volume 2. FGD cost estimates, appendices
[PB83-117366] p 29 N83-20469

Radian Corp., Sacramento, Calif.

Impact of air pollution control regulations on thermal enhanced oil recovery production in the United States
[DE82-011237] p 18 N83-18108

Rasor Associates, Inc., Sunnyvale, Calif.

Improved Stirling engine performance using jet impingement
p 158 N83-27288

Raymond Engineering Lab., Inc., Middletown, Conn.

A study of bolting problems, tools, and practices in the nuclear industry
[DE82-902203] p 168 N83-19099

Research Inst. of National Defence, Linköping (Sweden).

Laser depth sounding for locating oil below water surface. A preliminary survey
[FOA-C-30290-E1] p 98 N83-16753

Research Inst. of National Defence, Stockholm (Sweden).

The importance of satisfactory positioning, diving and mapping systems, suitable for exploration and transportation in ice-covered sea areas
[FOA-B-60003-M7] p 107 N83-17999

Research Triangle Inst., Research Triangle Park, N.C.

Photovoltaic cell and module status assessment. Volume 2. Technology basis
[DE83-900575] p 79 N83-21627

Photovoltaic cell and module status assessment. Volume 1. Technology overview
[DE83-900567] p 82 N83-22791

Reynolds Metals Co., Richmond, Va.

Effect of manganese additions on the performance of aluminum air-battery anode alloys
[DE83-002277] p 196 N83-21629

Rockefeller Univ., New York.

Some basic research problems related to energy
[DE83-003753] p 195 N83-21527

Rocket Research Corp., Redmond, Wash.

Sulfuric acid/water chemical heat pump/chemical energy storage, phases 1 and 2, phases 3 and 4
[DE83-001255] p 195 N83-20380

Rockwell International Corp., Canoga Park, Calif.

Partial liquefaction of coal by flash hydrolysis
[DE83-001145] p 126 N83-21077

Partial liquefaction of coal by flash hydrolysis, phase 4
[DE83-002167] p 127 N83-21085

Passive-Solar Commercial Buildings Program, 1980 - 1982
[DE82-012472] p 72 N83-21202

Rockwell International Corp., Pittsburgh, Pa.

Low concentration ratio solar array for low Earth orbit multi-100 kW application
[NASA-CR-170729] p 67 N83-20360

Rockwell International Corp., Seal Beach, Calif.

Design of large, low-concentration-ratio solar arrays for low earth orbit applications
p 49 N83-27254

Royal Inst. of Tech., Lund (Sweden).

Electric load of resistance heated one-family houses. An empirical analysis
[DE82-901536] p 6 N83-16923

RAND Corp., Santa Monica, Calif.

Future analysis, forecasting and planning for telecommunications, energy and public utilities
[RAND-P-6796] p 20 N83-18978

An Energy Crisis Management Simulation for the State of California
[RAND/R-2899-CEC] p 25 N83-20363

REAP Associates, Inc., Washington, D.C.

Federal energy conservation programs. Perspectives from the public and private sectors. Volume 2. Public hearing, July 14 and 15, 1981, Washington, D.C.
[PB82-238544] p 22 N83-19313

S**Saarbergwerke A.G. Saarbrueken (West Germany).**

Enlargement of the raw material basis of refineries by including hard coal. Pilot plant for coal hydrogenation, construction phase
[BMFT-FB-I-82-192] p 126 N83-21054

San Diego Unified School District, Calif.

Integrated solar heating, cooling, and hot-water system for University City High School, San Diego, California
[DE82-020993] p 75 N83-21555

Sandia Corp., Livermore, Calif.

Thermal fatigue tests of Solar One receiver-tube weldments
[DE82-012520] p 81 N83-22599

Sandia Labs., Albuquerque, N. Mex.

Interim Reliability Evaluation Program (IREP)
[DE82-004132] p 5 N83-16777

Variation in the microstructure of electrodeposited black chrome solar coatings
[DE81-030842] p 56 N83-16878

Game-theory approach to consumer incentives for solar energy
[DE82-004501] p 56 N83-16882

Intermediate photovoltaic system application experiment operational performance report for Lovington Square Shopping Center, Lovington, New Mexico
[DE83-000391] p 57 N83-16896

Intermediate photovoltaic system application experiment operational performance report. Volume 1. G. N. Wilcox Memorial Hospital, Kauai, Hawaii
[DE83-000393] p 57 N83-16897

Operational experiences of a downhole steam generator
[DE82-010161] p 100 N83-16906

Characterization and supporting research for in-situ coal-gasification research and development project plan
[DE83-000962] p 101 N83-16910

Mass flow of char/coal in oxygen-blown entrained-bed gasifiers. An assessment of instruments and methods of measurement
[DE82-006988] p 107 N83-17852

The 5 MW solar-chemistry development
[DE82-002064] p 60 N83-18043

Solar furnace for flux gage calibration and thermal-effects testing
[DE82-005769] p 62 N83-18062

Project DEEP STEAM
[DE82-010945] p 111 N83-18078

Site selection and characterization for an underground coal gasification test in Washington State. Volume 2. Project details
[DE82-010948] p 19 N83-18117

Experience in testing of a solution mined storage cavern
[DE82-011013] p 113 N83-18464

Contact stresses on a thin plate after large displacements to a half parabolic surface
[DE82-006998] p 63 N83-19136

High-temperature geothermal cableheads
[DE82-005864] p 117 N83-19302

Multiple-tracer gas analyzer
[DE82-017032] p 120 N83-19876

Controlled source audio-magnetotelluric (CSMAT) resistivity measurements for in-situ combustion
[DE82-016396] p 120 N83-19877

Thermal-convective-loop correction tests of 316SS and IN800 in molten nitrate salts
[DE82-012313] p 66 N83-19898

Photovoltaic-concentrator technology in the USA
[DE82-016399] p 68 N83-20387

Design, testing, and economics of a 430 W sub p photovoltaic concentrator array for non grid-connected applications
[DE82-014687] p 68 N83-20388

Photovoltaic retrofit feasibility in the United States
[DE82-014508] p 69 N83-20393

Design of a photovoltaic system for a southeast all-electric residence
[DE82-009349] p 69 N83-20394

Design and market study of photovoltaic systems for commercial building and applications. Volume 3. Appendices
[DE82-016729] p 70 N83-20397

Photovoltaic off-farm agricultural applications. Volume 1. Executive summary
[DE82-008487] p 70 N83-20398

Effects of gaps in adhesives that bond elastically deformed panels to parabolic, cylindrical substructures
[DE82-014720] p 72 N83-21154

Deformation of a thin, elastic plate to a deep parabolic cylinder
[DE82-012056] p 72 N83-21413

Intermediate photovoltaic system application experiment operational performance report. Volume 5. For CDC Light Manufacturing Building, San Bernardino, California, for July 1982
[DE83-003801] p 73 N83-21517

Modal testing of a rotating wind turbine
[DE83-003630] p 178 N83-21526

Shading analysis of a photovoltaic-cell string illuminated by a parabolic-trough concentrator
[DE83-002646] p 74 N83-21537

Photovoltaic concentrator with plastic-film reflector
[DE83-001715] p 75 N83-21547

A microprocessor-controlled photovoltaic-array loading unit
[DE83-000797] p 75 N83-21556

Central receiver test facility assembly building
[DE82-010853] p 76 N83-21567

Stress analysis of spherical mirror panels
[DE82-015656] p 77 N83-21585

Finite-element analysis and modal testing of a rotating wind turbine
[DE83-002609] p 180 N83-21608

Results of the PRDA 35 qualification tests of the BDM concentrating photovoltaic module
[DE83-002136] p 78 N83-21613

Manufacture, distribution, and handling of nitrate salts for solar-thermal applications
[DE83-003317] p 79 N83-21625

Vertical sampling flights in support of the 1981 ASCOT cooling tower experiments. Field effort and data
[DE82-014269] p 135 N83-21661

Intermediate photovoltaic system application experiment operational performance report. Volume 5, for Beverly High School, Beverly, Mass
[DE82-012058] p 81 N83-22774

Program for predicting thermal performance based on test data of low- to medium-temperature line-focusing, concentrating solar collectors
[DE82-012605] p 82 N83-22776

Thermal-receiver designs for line-focus solar collectors
[DE82-012067] p 82 N83-22777

Energy-transmission-system heat losses
[DE83-003628] p 187 N83-22786

Automated installation methods for photovoltaic arrays
[DE83-004272] p 82 N83-22796

Industry/Government Forum on Recent Policy and Budget Changes in the DOE Solar-Thermal Program
[DE82-012511] p 36 N83-22801

Perspective on our energy options
[DE82-005828] p 36 N83-22802

Study of battery accelerated-testing techniques
[DE82-017125] p 198 N83-22834

Sandia Labs., Livermore, Calif.

Testing and evaluation of second-generation heliostat mirror modules
[DE82-007934] p 77 N83-21582

Sargent and Lundy, Engineers, Chicago, Ill.

Compressed-air energy storage preliminary design and site development program in an aquifer Volume 3, part 1 Site Selection study
[DE82-001251] p 192 N83-16869

Compressed-air energy storage Preliminary design and site-development program in an aquifer Volume 3 Site-selection study, part 2
[DE83-001252] p 194 N83-18074

Science Applications, Inc., Chatsworth, Calif.

Study of net soot formation in hydrocarbon reforming for hydrogen fuel cells
[DE83-001046] p 90 N83-22352

Review of alternative fuels data bases
[NASA-CR-170203] p 140 N83-22439

Science Applications, Inc., La Jolla, Calif.

User's manual for heat-pump Seasonal-Performance Model (SPM) with selected parametric examples
[DE83-002455] p 31 N83-21552

User's manual for steady-state computer simulation for air-to-air heat pumps with selected examples
[DE83-002446] p 32 N83-21553

Program listing for air-to-air heat pump steady-state Computer-Simulation Mode (CSM)
[DE83-002549] p 32 N83-21559

Program listing for heat-pump Seasonal-Performance Model (SPM)
[DE83-002436] p 33 N83-21612

Coordination of the on-site fuel cell program
[PB83-119545] p 184 N83-22839

Science Applications, Inc., McLean, Va.

Assessment of distributed solar power systems Issues and impacts
[DE83-900640] p 78 N83-21618

Science Applications, Inc., Oak Ridge, Tenn.

Evaluation of utility home-energy-audit programs A Wisconsin example
[DE82-008134] p 6 N83-16924

Science Applications, Inc., Steamboat Springs, Colo. Stratigraphic variations in oil-shale fracture properties
[DE82-021088] p 136 N83-21702

Shell Development Co., Houston, Tex.

Exploitation deliberations
[DE82-007019] p 144 N83-22763

Shell Oil Co., Houston, Tex.

Coal-gas polymer demonstration project
[DE83-000772] p 105 N83-17726

Siemens A.G., Erlangen (West Germany). Continuously adjustable low-power gasifier burner/boiler system
[BMFT-FB-T-82-038] p 131 N83-21507

Singmaster and Breyer, New York.

Technical/commercial feasibility study of the production of fuel-grade ethanol for corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000772] p 129 N83-21173

Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana Volume 1 Executive summary
[DE83-000777] p 132 N83-21531

Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000776] p 132 N83-21532

Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana Volume 5 Appendices
[DE83-000773] p 133 N83-21534

Technical/commercial feasibility study of the production of fuel-grade ethanol from corn 100-million-gallon-per-year production facility in Myrtle Grove, Louisiana
[DE83-000774] p 133 N83-21535

Solamat, Inc., East Providence, R.I.

Research on application of Arc-Plasma Spraying (APS)
[DE82-015220] p 70 N83-20408

Solar Business Office, Sacramento, Calif.

Solar for industry
[DE83-003301] p 68 N83-20381

Solar Turbines International, San Diego, Calif.

Centaur gas-turbine modification and development for solar-fossil hybrid operation
[DE83-900192] p 177 N83-21366

Solarex Corp., Rockville, Md.

Design and fabrication of a prototype system for a photovoltaic residence in the Northeast
[DE82-022497] p 55 N83-16871

Silicon concentrator cell-assembly development
[DE83-001683] p 84 N83-22822

South Coast Technology, Inc., Ann Arbor, Mich.

Review and evaluation of automotive fuel conservation technologies
[PB83-101139] p 30 N83-20844

South Dakota School of Mines and Technology, Rapid City. Energy from humid air
[DE82-017121] p 180 N83-21601

Southern California Edison Co., Rosemead. Investigation of methanol as a boiler fuel for electric-power generation
[DE82-905495] p 97 N83-16560

Utility experience with two demonstration wind turbine generators
[DE83-101339] p 173 N83-19266

Southern California Gas Co., Los Angeles. Metal hydride/chemical heat-pump development project, phase 1
[DE83-002463] p 27 N83-20429

Southern Methodist Univ., Dallas, Tex. Heat flow and geothermal potential of Kansas
[DE83-003235] p 134 N83-21609

Southern Services, Inc., Birmingham, Ala. Catalytic hydrogenation unit studies
[DE83-003390] p 137 N83-22342

Southern Solar Energy Center, Inc., Atlanta, Ga. Energy considerations Mobile homes in the south
[DE82-009586] p 17 N83-18068

Development of residential-conservation-survey methodology for the US Air Force Task 2
[DE82-009473] p 18 N83-18077

Economic feasibility of solar thermal industrial applications and selected case studies
[DE82-009503] p 66 N83-19303

Southwest Research Inst., San Antonio, Tex. Metallurgical investigation of disc cracking in the LP-2 turbine at a nuclear power station
[DE82-906428] p 162 N83-16515

Nonstandard aging tests on coal-derived distillate fuels
[DE82-010442] p 97 N83-16562

Degradation and characterization of antimisting kerosene (AMK)
[MED-132] p 120 N83-19922

Fuel property effects on diesel engine and gas turbine combustor performance
[AD-A120879] p 175 N83-20161

Refining studies and engine testing of alternative highway-transportation fuels Identification and evaluation of optimized alternative fuels
[DE83-003332] p 129 N83-21172

Characterization of exhaust emissions from methanol- and gasoline-fueled automobiles
[PB83-116830] p 149 N83-23249

Spectrolab, Inc., Sylmar, Calif. Development of metallization process, FSA project, cell and module formation research area
[NASA-CR-169902] p 63 N83-19220

Large area, low cost solar cell development and production readiness
[NASA-CR-170037] p 73 N83-21512

Spectron Development Labs., Inc., Costa Mesa, Calif. Particulate processes in pulverized-coal flames
[DE82-014306] p 140 N83-22367

Sperry Research Center, Sudbury, Mass. Sperry low-temperature geothermal conversion system Volume 1 Organic-working-fluid properties
[DE82-018529] p 163 N83-16867

Stanford Univ., Calif. Modeling water supply for the energy sector
[DE82-906440] p 27 N83-20433

World oil
[DE83-001149] p 177 N83-21246

Hall-Field limitations in MDH generators
[DE82-021183] p 36 N83-22816

International Energy Workshop, 1981
[DE83-004480] p 136 N83-21703

Stapenhorst (F. W. E.), Inc., Pointe Claire (Quebec). DOE small-scale hydroelectric demonstration program F W E Stapenhorst, Inc., Goodyear Lake hydroelectric-generating-station redevelopment
[DE83-003156] p 182 N83-22780

State Univ. of New York at Buffalo, Amherst. Geothermal investigations in West Virginia
[DE83-004480] p 136 N83-21703

State Univ. of New York, Binghamton. Desulfurization with transition metal catalysts
[DE83-003062] p 126 N83-21071

State Univ. of New York, Buffalo. Catalytic coal liquefaction
[DE83-001098] p 127 N83-21078

Technion - Israel Inst. of Tech., Haifa.

Catalytic coal liquefaction
[DE82-012562] p 139 N83-22363

State Univ. of New York, Stony Brook. Coal-waste artificial-reef program, phase 3 Volume 2 Comprehensive report
[DE82-005591] p 8 N83-16954

Steinmueller (L. and C.) G.m.b.H., Gummersbach (West Germany). Development of heat exchangers for reheating scrubbed flue gas in a pilot plant
[BMFT-FB-T-82-169] p 13 N83-17840

Structural Composites Industries, Inc., Azusa, Calif. Low-cost composite blades for the Mod-0A wind turbines
[DE83-001252] p 170 N83-19242

Stuttgart Univ. (West Germany). ARLIS 1.0 Linear investigation of aeroelastic systems in rotation
[ISD-293] p 166 N83-17905

Linear static and dynamic analysis for hinged rotor blades of 60 m span for a two bladed horizontal axis wind energy converter
[ISD-291] p 167 N83-18030

Swedish Council for Building Research, Stockholm. Solar district heating with evacuated collectors First year experience of the Knivsta plant
[PB82-262114] p 59 N83-16939

Survey of the international development in indoor climate control
[PB83-100461] p 67 N83-19962

Swedlow, Inc., Garden Grove, Calif. Design and development of monolithic acrylic Fresnel lenses for use in point-focus PV systems
[DE82-007554] p 72 N83-20768

Syracuse Research Corp., N. Y. Exterior insulating shutter final prototype design
[DE83-004520] p 33 N83-21616

Systems Control, Inc., West Palm Beach, Fla. The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations
[DE83-000820] p 34 N83-21651

Systems Science and Software, San Diego, Calif. Dynamic simulation of sulfur-removal systems
[DE82-902074] p 119 N83-19865

SDC/Integrated Services, Inc., McLean, Va. Preliminary evaluation of environmental issues on the use of peat as an energy source
[DE83-000820] p 34 N83-21651

SECO (Belgium). General review of wind engineering problems
[DE83-000820] p 114 N83-18944

SRI International Corp., Menlo Park, Calif. Workshop on the Status of Industrial Organic Electrochemistry, summary
[DE82-901982] p 103 N83-17647

Review of Thawtron device for thawing frozen coal
[DE82-903145] p 123 N83-20330

Exploratory study of coal conversion chemistry
[DE82-013414] p 138 N83-22354

Development and demonstration of a reverse-osmosis energy-recovery device
[PB83-108605] p 140 N83-22380

STD Research Corp., Arcadia, Calif. Analytical investigation of critical MHD phenomena
[NASA-CR-168079] p 169 N83-19228

STEAG A.G., Essen (West Germany). Testing of heat exchanger systems for reheating flue gases from wet scrubbing desulfurization plants
[BMFT-FB-T-82-170] p 13 N83-17841

Flue gas desulfurization with waste water evaporation Phase 2 Observation of the experiments at Weiher II
[BMFT-FB-T-82-026] p 125 N83-21053

T

Tate and Lytle Technical Services Ltd., Coral Gables, Fla. The engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co.-op, Inc. at Thibodaux, Louisiana Attachment A Volume 2 Definition of facilities and scope of work for an ethanol facility to be located at Thibodaux, Louisiana
[DE83-001165] p 147 N83-22829

Technicon Analytic Research, Inc., Philadelphia, Pa. National forecast for geothermal resource exploration and development with techniques for policy analysis and resource assessment
[DE82-014641] p 133 N83-21588

Technical Univ. of Denmark, Lyngby. Technical standards for fuel consumption in private automobiles
[DE82-900748] p 106 N83-17735

Technion - Israel Inst. of Tech., Haifa. The use of slurry fuels in industrial furnaces
[TAE-428] p 106 N83-17729

Technische Hochschule, Hanover (West Germany).

Design and standardization of meteorological measurements for wind energy converting systems [BMFT-FB-T-82-168] p 168 N83-18172

Technische Hochschule, Karlsruhe (West Germany).

Application of energy dispersive X-ray fluorescence, ion sensitive electrodes and instrumental neutron activation in geochemical prospecting [BMFT-FB-T-82-152] p 111 N83-18123

Telodyne Continental Motors, Mobile, Ala.

The spark-ignition aircraft piston engine of the future p 141 N83-22450

Tennessee Valley Authority, Chattanooga.

Energy use test facility CAC-DOE solar air heater test report [DE83-900162] p 75 N83-21546

Tennessee Valley Authority, Muscle Shoals, Ala.

Programmatic environmental overview Biomass fuels program [DE82-906065] p 101 N83-16975

Texaco, Inc., El Monte, Calif.

Enriched-air and oxygen gasification of Illinois No. 6 coal in a Texaco coal-gasification unit [DE82-903133] p 139 N83-22362

Texas A&M Univ., College Station

Thermodynamic properties for natural gas binaries [PB82-254616] p 98 N83-16565
Economic and engineering evaluation of plant oils as a diesel fuel [DE83-900805] p 141 N83-22464

Ethanol production in small- to medium-size facilities [DE83-900875] p 146 N83-22807

Texas Univ., Austin.

Future landscapes of the Colorado plateau Impacts of energy development [DE83-900473] p 34 N83-21666
Integrated passive-solar demonstration project [DE83-900807] p 82 N83-22795
Passive-solar homes for Texas [DE83-900806] p 83 N83-22818

Thermacore, Inc., Lancaster, Pa.

Long titanium heat pipes for high-temperature space radiators p 185 A83-27127

Thermo Electron Corp., Waltham, Mass.

Thermionic technology infrastructure for space power p 159 A83-27298
Open-cycle vapor compression heat pump [PB82-262569] p 8 N83-16947
Preliminary analysis of the state of the art of robotics and precision engineering and evaluation of potential for improved energy utilization in the pulp, paper, and related energy-consuming processes [DE83-001016] p 21 N83-19294
The development of solar-assisted gas-fired appliances, phase 2 [PB82-231663] p 66 N83-19312

Toronto Univ. (Ontario).

Corrosion of 310 stainless steel in H₂-H₂O-H₂S gas mixtures Studies at constant temperature and fixed oxygen potential p 90 A83-20265

Total Environmental Action, Inc., Harrisville, N.H.

Residential-appliance load characteristics [DE82-012883] p 13 N83-17824

Townsend (Anne) Associates, Inc., Arlington, Va.

Passive-Solar Commercial Buildings Program, 1980 - 1982 [DE82-012472] p 72 N83-21202

Trans Energy Systems, Inc., Bellevue, Wash.

Bellingham Phase 3, Engineering and technology development for a hot-water district-heating system employing thermal-energy storage [DE82-000106] p 192 N83-16862

Trans Systems Corp., Vienna, Va.

Assessment of battery buses and battery technology [PB82-260019] p 11 N83-17428

Transamerica Delaval, Inc., Oakland, Calif.

Emulsified fuel testing in a medium speed diesel engine [PB82-250697] p 98 N83-16564

Transco Energy Co., Houston, Tex.

Transco medium-Btu coal gasification project Feasibility study, volume 1 [DE82-009597] p 119 N83-19872
Transco medium-Btu coal gasification project Feasibility study, volume 2 [DE82-009596] p 119 N83-19873
Transco medium-Btu coal gasification project Feasibility study, volume 3 [DE82-009595] p 120 N83-19874

Trinity Univ., San Antonio, Tex.

Solar-regenerated desiccant dehumidification [DE83-900823] p 83 N83-22809

TriSolar Corp., Bedford, Mass.

Design and fabrication of a prototype system for photovoltaic residences in the southwestern United States [DE83-002532] p 78 N83-21607

Tufts Univ., Medford, Mass.

The New England Energy Congress Project [DE82-005521] p 16 N83-18041

TRW Defense and Space Systems Group, Redondo Beach, Calif.

Solar array switching power management p 45 A83-27132
Development of technologies for welding interconnects to fifty-micron thick silicon solar cells [NASA-CR-170212] p 81 N83-22742

TRW Space Technology Labs., Redondo Beach, Calif.

Study of solar array switching power management technology for space power system [NASA-CR-167890] p 81 N83-22756

TRW, Inc., Redondo Beach, Calif.

Cassegrainian concentrator solar array exploratory development module p 49 A83-27250

U

United Air Lines, Inc., Denver, Colo.

Computerized engine and airplane performance monitoring programs p 12 N83-17465

United Engineers and Constructors, Inc., Philadelphia, Pa.

Preliminary design study of compressed-air energy storage in a salt dome Volume 6 CAES plant design [DE82-014355] p 196 N83-21580

United Technologies Corp., East Hartford, Conn.

Chemical effects in vaporizing synthetic fuels [DE82-003352] p 96 N83-16549
Solar/gas Rankine/Rankine-cycle heat pump assessment [PB82-254863] p 55 N83-16710
Evaluation of industrial advanced heat recovery/thermal energy storage systems [DE82-906475] p 193 N83-16919

United Technologies Corp., South Windsor, Conn.

On-site fuel cell power plant technology development program [PB83-102335] p 176 N83-20437

On-site fuel cell field test support program [PB83-121723] p 28 N83-20439

United Technologies Research Center, East Hartford, Conn.

Experimental study of the thermal stability of hydrocarbon fuels [NASA-CR-168027] p 105 N83-17728
Flow distribution control characteristics in manne gas turbine waste-heat recovery system Phase 2 Flow distribution control in waste-heat steam generators [AD-A119310] p 175 N83-20054
Ceramic heat-exchanger applications study [DE83-003166] p 132 N83-21529
Development of an oscillating-vane concept as an innovative wind-energy-conversion system [DE82-012870] p 179 N83-21599

University of South Florida, St. Petersburg.

Workshop report on Basic Research in Organic Geochemistry Applied to National Energy Needs [DE82-007074] p 144 N83-22760

Summary of recommendations on basic research p 35 N83-22761

Utah State Univ., Logan

Design considerations in the use of Glauber salt for energy storage [DE82-019289] p 192 N83-16866

Utah Univ., Salt Lake City.

Chemistry and catalysis of coal liquefaction Catalytic and thermal upgrading of coal liquid and hydrogenation of CO to produce fuels [DE82-012474] p 119 N83-19870

Geothermal potential of Ascension Island, south Atlantic Phase 1 Preliminary examination [DE83-004066] p 132 N83-21523

Geothermal Direct Heat Program Roundup, volume 1 [DE82-019912] p 135 N83-21628

UOP, Inc., McLean, Va.

Preliminary evaluation of environmental issues on the use of peat as an energy source [DE83-000820] p 34 N83-21651

V

Van Wyk and Louw, Inc., Pretoria (South Africa).

Gasoline shortfall management p 148 N83-23213

Varian Associates, Palo Alto, Calif.

Single and multijunction space solar cells grown by organometallic vapor phase epitaxy /OM-VPE/ p 50 A83-27260

Accelerated aging of GaAs concentrator solar cells [DE82-016658] p 69 N83-20390

Design and demonstration of a spectrum-splitting photovoltaic concentrator module [DE83-003669] p 79 N83-21634

Vereinigte Elektrizitätswerke Westfalen A.G., Dortmund (West Germany).

Testing of heat exchanger systems for reheating flue gases from wet scrubbing desulfurization plants [BMFT-FB-T-82-170] p 13 N83-17841

Vetter Research, Costa Mesa, Calif.

Reinjection and injection of fluids in geothermal operations (state of the art) [DE83-001857] p 135 N83-21632

Virginia Inst. of Marine Science, Gloucester Point.

Examination of tidal flats Volume 3 Evaluation methodology [PB83-11805] p 148 N83-22949

Virginia Polytechnic Inst. and State Univ., Blacksburg.

An on-board near-optimal climb-dash energy management [NASA-CR-169755] p 4 N83-16329

Acid precipitation A critique of present knowledge and proposed action [DE83-900303] p 34 N83-21650

Virginia Univ., Charlottesville.

Coastal zone wind energy Part 3 A procedure to determine the wind power potential of the coastal zone [DE82-014334] p 134 N83-21598

Vitro Labs., Silver Spring, Md.

Comparative report Performance of solar hot-water systems, 1980 - 1981 [DE83-000069] p 56 N83-16889

Rymark 1, Rymark 2, and Rymark 3, Frederick, Maryland Solar-energy-system performance evaluation, May 1981 through March 1982 [DE83-000067] p 57 N83-16890

Contemporary Systems, Inc., Walpole, New Hampshire solar-energy-system performance evaluation [DE83-000068] p 57 N83-16894

Gill Harrop, Big Flats, New York solar-energy-system performance evaluation [DE83-000065] p 57 N83-16895

Vitro Labs., West Orange, N.J.

September 1982 environmental data for sites in the National Solar Data Network [DE83-001839] p 80 N83-21722

Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

Heavy Gas Dispersal [VKI-LS-1982-03] p 200 N83-19316

W

Washington Resources, Inc., Washington, D.C.

Analysis of the economics of typical business applications of solar energy [DE82-013419] p 71 N83-20410

Washington State Univ., Pullman.

Characteristics of coal/light hydrocarbon slimes in spray combustion [DE82-006294] p 102 N83-17639

Low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington [DE83-001433] p 145 N83-22789

Washington Univ. Technology Associates, Inc., St. Louis, Mo.

The investigation of passive blade cyclic pitch variation using an automatic yaw control system [DE83-000651] p 178 N83-21548

Washington Univ., Seattle.

Radiative energy receiver for high performance energy conversion cycles p 46 A83-27138

Washington Univ., St. Louis, Mo.

Theoretical and experimental studies of fixed-bed coal gasification reactors [DE82-009515] p 104 N83-17655

Weed (Thurlow) and Associates, Inc., Columbus, Ohio.

Devonian shale extraction test wells [DOE/MC-08386/T1] p 108 N83-18013

Westinghouse Electric Corp., Concordville, Pa.

Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, part 2, appendix F Dynamic system computer model [DE83-004004] p 197 N83-22758

Compressed-air energy storage preliminary design and site development program in an aquifer Volume 5, Part 1 Turbomachinery design [DE83-004005] p 197 N83-22759

CORPORATE SOURCE

Zalinger Engineering Co., San Jose, Calif.

Westinghouse Electric Corp., Pittsburgh, Pa.

The MOD-OA 200 kilowatt wind turbine generator design and analysis report

[NASA-CR-165127] p 163 N83-16859

Design and fabrication of a prototype system for photovoltaic residences in the Northeast

[DE82-022210] p 55 N83-16872

HYFIRE A Tokamak/high-temperature electrolysis system

[DE82-004806] p 68 N83-17323

Evaluation of gasification and gas-cleanup processes for use in molten-carbonate fuel-cell power plants

[DE82-012244] p 167 N83-18084

Process research of non-cz silicon material Low cost solar array project, cell and module formation research area

[NASA-CR-169899] p 63 N83-19221

Multiple and variable speed electrical generator systems for large wind turbines

[DE82-012244] p 170 N83-19236

Gas characterization from fluidized-bed coal gasification

[DE82-012396] p 138 N83-22357

HYFIRE A Tokamak/high-temperature electrolysis system

[DE82-013851] p 90 N83-23173

Westinghouse Research and Development Center, Pittsburgh, Pa.

Trace and minor element reactions in fluidized-bed combustion processes

[PB82-240219] p 113 N83-18883

Development of copper sulfide/cadmium sulfide thin-film solar cells

[DE83-001421] p 74 N83-21539

Materials research for hydrogen-cooled Superconducting Power-Transmission Lines (SPTL) Part 1 Liquid hydrogen as a dielectric Part 2 Superconducting materials

[DE83-004801] p 187 N83-22529

Evaluation of gasification and gas cleanup processes for use in molten carbonate fuel cell power plants

[DE83-003821] p 183 N83-22787

Windfarms Ltd., San Francisco, Calif.

The 80 megawatt wind power project at Kahuku Point, Hawaii

[DE83-001118] p 172 N83-19264

Wisconsin Dept. of Administration, Madison.

Wisconsin collector-efficiency study, phase two

[DE82-013425] p 71 N83-20426

Wisconsin Univ., Madison.

An assessment of wind characteristics and wind energy conversion systems for electric utilities

[PB82-258971] p 165 N83-16935

Fuel-composition and -vaporization effects on combustion-chamber deposits

[DE82-012576] p 104 N83-17670

Simulation and design of passive processes

[DE82-016647] p 70 N83-20401

Assessment of research directions for high-voltage direct-current power systems

[DE83-001118] p 177 N83-21247

Superconductive energy storage

[DE83-002270] p 196 N83-21624

Wolf (Ludwig, Jr.), Crystal Lake, Ill.

The design, effectiveness and construction of passive-thermal-control roofing shingles

[DE83-001465] p 75 N83-21557

Woodard-Clyde Consultants, San Francisco, Calif.

Decision framework for technology choice Volume 1

A case study of one utility's coal-nuclear choice

[DE82-902213] p 113 N83-18554

Monitoring well systems in geothermal areas

[DE82-012770] p 133 N83-21586

Woods Hole Oceanographic Institution, Mass.

Petroleum contamination Quantification and passive tagging in organisms and sediments

[PB82-254087] p 113 N83-18880

Problems in organic geochemistry applied to petroleum exploration and production

[DE82-012770] p 144 N83-22765

Wright-Malta Co., Ballston Spa, N. Y.

Catalyzed steam gasification of biomass Phase 3 Biomass Process Development Unit (PDU) construction and initial operation

[DE82-010264] p 124 N83-20415

WTG Energy Systems, Inc., Buffalo, N.Y.

Operational experience on the MP-200 series commercial wind turbine generators

[DE83-900279] p 172 N83-19259

Z

Zalinger Engineering Co., San Jose, Calif.

Benefits to utility systems of coproduction of methanol and electricity

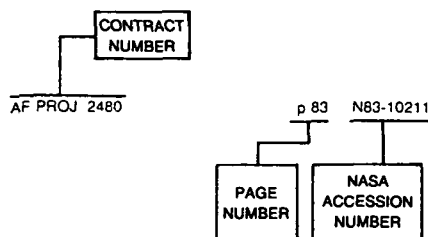
[DE83-900279] p 101 N83-16913

CONTRACT NUMBER INDEX

ENERGY / A Continuing Bibliography (Issue 38)

JULY 1983

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the AIAA accession numbers appearing first. The accession number denotes the number by which the citation is identified in either the IAA or STAR section.

AF PROJ 1900 p 13 N83-17731
 AF PROJ 2301 p 163 N83-16861
 AF PROJ 2306 p 64 N83-19279
 AF PROJ 2308 p 195 N83-20375
 AF PROJ 2404 p 15 N83-18035
 AF PROJ 3048 p 129 N83-21169
 AF PROJ 3145 p 194 N83-19277
 AF PROJ 6302 p 30 N83-21168
 AF-OFOSR-0200-82 p 64 N83-19279
 AT(49-24)-0256 p 145 N83-22790
 BMFT-ET-4086-A p 167 N83-18030
 BMFT-ET-4406-A/B p 166 N83-17905
 DA PROJ 1L1-62733-AH-20 p 174 N83-19278
 DA PROJ 1L7-62733-AH-20 p 175 N83-20161
 DAAK70-80-C-0001 p 175 N83-20161
 DAAK70-82-C-0001 p 175 N83-20161
 DAAK70-82-C-0042 p 174 N83-19275
 DAAK70-82-C-0046 p 174 N83-19278
 DE-AB01-76CS-31020 p 65 N83-19283
 DE-AC01-76CS-18458 p 77 N83-21570
 DE-AC01-76ET-10163 p 24 N83-19950
 DE-AC01-76ET-10340 p 121 N83-19941
 DE-AC01-77ET-29332 p 181 N83-22607
 DE-AC01-78ET-10159 p 196 N83-21580
 DE-AC01-78ET-13005 p 34 N83-21651
 DE-AC01-78ET-13005 p 104 N83-17676
 DE-AC01-78ET-29163 p 146 N83-22823
 DE-AC01-78ET-29299 p 186 N83-18102
 DE-AC01-79CS-10757 p 5 N83-16653
 DE-AC01-79CS-20175 p 31 N83-21552
 DE-AC01-79CS-30027 p 32 N83-21553
 DE-AC01-79CS-30027 p 32 N83-21559
 DE-AC01-79CS-30027 p 33 N83-21612
 DE-AC01-79CS-50017 p 138 N83-22353
 DE-AC01-79ET-20622 p 56 N83-16889
 DE-AC01-79ET-23052 p 57 N83-16890
 DE-AC01-80CS-50005 p 57 N83-16894
 DE-AC01-80CS-50005 p 57 N83-16895
 DE-AC01-80CS-50005 p 64 N83-19280
 DE-AC01-80CS-50005 p 80 N83-21722
 DE-AC01-80CS-50005 p 129 N83-21172
 DE-AC01-80CS-50005 p 27 N83-20427
 DE-AC01-80CS-50005 p 180 N83-21601
 DE-AC01-80CS-50005 p 129 N83-21174
 DE-AC01-80CS-50005 p 129 N83-21175
 DE-AC01-80CS-50005 p 130 N83-21177
 DE-AC01-80CS-50005 p 130 N83-21178
 DE-AC01-80CS-50093 p 87 A83-27334
 DE-AC01-80CS-50134 p 20 N83-18592
 DE-AC01-80CS-50179 p 142 N83-22467
 DE-AC01-80CS-50179 p 142 N83-22468

DE-AC01-80CS-80002
 DE-AC01-80CS-80004
 DE-AC01-80ET-15234
 DE-AC01-80ET-15611
 DE-AC01-80EV-10354
 DE-AC01-80RA-50282
 DE-AC01-81CS-24454
 DE-AC01-81EI-10752
 DE-AC01-81FE-05147
 DE-AC01-81FE-15078
 DE-AC01-81FE-15086
 DE-AC02-76CH-00016

DE-AC02-76ET-11291
 DE-AC02-76ET-11292
 DE-AC02-76ET-15352
 DE-AC02-76ET-20279
 DE-AC02-76ET-26602
 DE-AC02-76ET-28317
 DE-AC02-76EV-01340
 DE-AC02-77CH-00178

DE-AC02-76ET-26602
 DE-AC02-76ET-28317
 DE-AC02-76EV-01340
 DE-AC02-77CH-00178

p 21 N83-19291
 p 21 N83-19292
 p 88 N83-17633
 p 168 N83-19102
 p 177 N83-21246
 p 34 N83-21638
 p 183 N83-22832
 p 146 N83-22812
 p 16 N83-18051
 p 105 N83-17678
 p 179 N83-21549
 p 183 N83-22827
 p 5 N83-16569
 p 55 N83-16688
 p 56 N83-16877
 p 56 N83-16879
 p 7 N83-16926
 p 88 N83-17323
 p 186 N83-17342
 p 89 N83-17740
 p 61 N83-18049
 p 110 N83-18061
 p 21 N83-19290
 p 66 N83-19297
 p 195 N83-20380
 p 26 N83-20420
 p 71 N83-20428
 p 27 N83-20429
 p 80 N83-21643
 p 137 N83-22336
 p 197 N83-22770
 p 198 N83-22815
 p 90 N83-23173
 p 159 A83-27298
 p 159 A83-27300
 p 51 A83-27301
 p 159 A83-27299
 p 178 N83-20421
 p 55 N83-16871
 p 55 N83-16872
 p 55 N83-16873
 p 57 N83-16898
 p 58 N83-16908
 p 61 N83-18044
 p 71 N83-20416
 p 72 N83-21200
 p 78 N83-21607
 p 80 N83-22534
 p 196 N83-21624
 p 128 N83-21136
 p 31 N83-21525
 p 56 N83-16881
 p 164 N83-16883
 p 57 N83-16900
 p 58 N83-16917
 p 60 N83-17001
 p 60 N83-17723
 p 13 N83-17824
 p 61 N83-18046
 p 61 N83-18059
 p 62 N83-18063
 p 167 N83-18071
 p 113 N83-18875
 p 174 N83-19282
 p 124 N83-20395
 p 175 N83-20403
 p 70 N83-20404
 p 71 N83-20409
 p 71 N83-20417
 p 124 N83-20418
 p 129 N83-21176
 p 74 N83-21539
 p 31 N83-21543
 p 178 N83-21548
 p 76 N83-21568
 p 76 N83-21569
 p 134 N83-21596
 p 32 N83-21597
 p 179 N83-21599
 p 79 N83-21620
 p 182 N83-22783
 p 83 N83-22799
 p 83 N83-22814

DE-AC02-77ER-04263
 DE-AC02-77ET-29100
 DE-AC02-78ER-04749
 DE-AC02-78ER-05003
 DE-AC02-78ET-23025
 DE-AC02-78ET-29185
 DE-AC02-78ET-29232
 DE-AC02-78EV-10131
 DE-AC02-79CS-30150
 DE-AC02-79CS-30159
 DE-AC02-79CS-30166

DE-AC02-79CS-50108
 DE-AC02-79ER-10343
 DE-AC02-79ER-10347
 DE-AC02-79ER-10519
 DE-AC02-79ET-10815
 DE-AC02-79ET-27242
 DE-AC02-79ET-29354
 DE-AC02-80CS-0179
 DE-AC02-80CS-30401
 DE-AC02-80ER-10677
 DE-AC02-80ET-26225
 DE-AC02-80PE-70228
 DE-AC02-80RA-50274
 DE-AC02-81CS-30632
 DE-AC02-81CS-50048
 DE-AC02-81CS-80024
 DE-AC02-81CS-90215
 DE-AC02-81ER-10807
 DE-AC02-81PE-70326
 DE-AC02-82CH-10116
 DE-AC03-76ET-11304
 DE-AC03-76SF-00012
 DE-AC03-76SF-00098

DE-AC03-76SF-00700
 DE-AC03-77ET-13001
 DE-AC03-78ET-20517
 DE-AC03-78ET-27125
 DE-AC03-78ET-27146
 DE-AC03-78SF-01863
 DE-AC03-79ET-11322
 DE-AC03-79ET-23043
 DE-AC03-79SF-10499
 DE-AC03-81CS-30574
 DE-AC03-81SF-11492
 DE-AC03-81SF-11526
 DE-AC04-76D-00789
 DE-AC04-76DP-00053
 DE-AC04-76DP-00656
 DE-AC04-76DP-00789

p 84 N83-22831
 p 78 N83-21560
 p 164 N83-16915
 p 70 N83-20408
 p 67 N83-19917
 p 124 N83-20415
 p 177 N83-21247
 p 192 N83-16869
 p 194 N83-18074
 p 197 N83-22758
 p 197 N83-22759
 p 16 N83-18041
 p 71 N83-20426
 p 101 N83-16928
 p 17 N83-18068
 p 18 N83-18077
 p 68 N83-19303
 p 37 N83-23245
 p 196 N83-21639
 p 47 N83-27231
 p 70 N83-20407
 p 151 N83-23130
 p 133 N83-21568
 p 187 N83-22529
 p 130 N83-21185
 p 6 N83-16903
 p 120 N83-19879
 p 88 N83-17633
 p 16 N83-18039
 p 183 N83-22784
 p 70 N83-20402
 p 141 N83-22461
 p 21 N83-19294
 p 159 A83-27298
 p 195 N83-21527
 p 25 N83-20334
 p 83 N83-22808
 p 153 A83-25536
 p 85 N83-22856
 p 161 A83-28300
 p 192 N83-16896
 p 124 N83-20414
 p 33 N83-21617
 p 135 N83-21686
 p 142 N83-22568
 p 145 N83-22781
 p 83 N83-22798
 p 105 N83-17726
 p 43 A83-24761
 p 163 N83-16867
 p 135 N83-21632
 p 18 N83-18108
 p 149 A83-19884
 p 149 A83-19891
 p 68 N83-20382
 p 65 N83-19295
 p 75 N83-21551
 p 73 N83-21521
 p 74 N83-21530
 p 58 N83-16909
 p 58 N83-16914
 p 65 N83-19296
 p 74 N83-21542
 p 56 N83-16878
 p 162 N83-16556
 p 168 N83-18511
 p 197 N83-22785
 p 43 A83-23884
 p 5 N83-16777
 p 56 N83-16882
 p 57 N83-16896
 p 57 N83-16897
 p 100 N83-16906
 p 101 N83-16910
 p 107 N83-17852
 p 60 N83-18043
 p 62 N83-18062
 p 62 N83-18072
 p 111 N83-18078
 p 19 N83-18117
 p 113 N83-18464
 p 63 N83-19136
 p 65 N83-19286

CONTRACT

p 65	N83-19287		p 115	N83-19237		p 181	N83-22747
p 65	N83-19293		p 116	N83-19238	DE-AI01-76ET-20356	p 64	N83-19225
p 117	N83-19302		p 116	N83-19239	DE-AI01-76ET-20370	p 163	N83-16859
p 174	N83-19595		p 116	N83-19240	DE-AI01-77CS-51040	p 166	N83-17423
p 120	N83-19876		p 171	N83-19248		p 24	N83-19651
p 120	N83-19877		p 171	N83-19253	DE-AI01-77CS-51044	p 182	N83-22749
p 66	N83-19898		p 20	N83-19289	DE-AI01-77ET-10350	p 123	N83-20361
p 24	N83-19956		p 174	N83-19398	DE-AI01-77ET-10769	p 169	N83-19228
p 68	N83-20387		p 124	N83-20414		p 117	N83-19812
p 68	N83-20388		p 127	N83-21084		p 182	N83-22748
p 69	N83-20389		p 130	N83-21328	DE-AI01-78CS-54209	p 191	N83-16858
p 69	N83-20390		p 196	N83-21528	DE-AI01-79ET-20320	p 169	N83-19226
p 69	N83-20391		p 134	N83-21598		p 181	N83-22746
p 69	N83-20392		p 180	N83-21622	DE-AI01-80ER-10159	p 33	N83-21619
p 69	N83-20393		p 135	N83-21631	DE-AI02-80CH-10064	p 195	N83-20376
p 69	N83-20394		p 180	N83-21633	DE-AI04-80AL-12726	p 194	N83-20359
p 69	N83-20396		p 197	N83-21640	DE-AJ01-77ET-13111	p 143	N83-22750
p 70	N83-20398		p 136	N83-21694		p 143	N83-22751
p 72	N83-20768		p 136	N83-21723	DE-AM01-78EI-02295	p 19	N83-18109
p 72	N83-21154		p 197	N83-22804	DE-AM03-76SF-00700	p 72	N83-21202
p 72	N83-21413		p 198	N83-22805	DE-AM04-80AL-13137	p 64	N83-19224
p 73	N83-21517		p 198	N83-22806	DE-AP20-82LC-00389	p 136	N83-21702
p 74	N83-21522	DE-AC07-76ID-01570	p 100	N83-16893	DE-AS02-77CS-34383	p 78	N83-21604
p 178	N83-21526		p 164	N83-16901	DE-AS02-77CS-40051	p 15	N83-18036
p 74	N83-21537		p 164	N83-16904	DE-AS05-78ER-05947	p 140	N83-22436
p 74	N83-21541		p 166	N83-17331	DE-AS07-28365	p 135	N83-21628
p 75	N83-21547		p 104	N83-17661	DE-AS07-77ET-28365	p 110	N83-18073
p 75	N83-21556		p 107	N83-17754	DE-AS07-79ET-17104	p 143	N83-22698
p 76	N83-21562		p 15	N83-18038	DE-AS07-79ET-27204	p 134	N83-21609
p 76	N83-21563		p 125	N83-20434		p 136	N83-21701
p 76	N83-21564		p 132	N83-21523		p 143	N83-22697
p 76	N83-21566		p 133	N83-21586		p 145	N83-22790
p 76	N83-21567	DE-AC07-79ET-27014	p 145	N83-22789	DE-AS07-80ID-12172	p 100	N83-16874
p 77	N83-21582	DE-AC07-81ID-12314	p 178	N83-21544	DE-AS19-81BC-10449	p 122	N83-20171
p 77	N83-21584	DE-AC08-76NV-00020	p 135	N83-21621	DE-AT01-76ET-10696	p 181	N83-22484
p 77	N83-21585	DE-AC08-76NV-01183	p 98	N83-16834	DE-AT01-76ET-10703	p 117	N83-19829
p 77	N83-21603	DE-AC08-79ET-27008	p 135	N83-21621	DE-AT02-76CH-93012	p 174	N83-19309
p 78	N83-21605	DE-AC08-81NV-10177	p 110	N83-18070	DE-AT03-76ER-70234	p 95	N83-16427
p 78	N83-21606	DE-AC09-76SR-00001	p 129	N83-21171	DE-AT03-76ET-10699	p 128	N83-21127
p 180	N83-21608		p 137	N83-21934	DE-AT03-79PE-70117	p 36	N83-22816
p 78	N83-21613	DE-AC13-76G-01664	p 99	N83-16844	DE-AT03-80SF-11458	p 100	N83-16907
p 78	N83-21615	DE-AC13-76GJ-01664	p 99	N83-16838	DE-AT06-79ET-23144	p 171	N83-19252
p 79	N83-21625		p 115	N83-19196	DE-FC01-77ET-10069	p 12	N83-17673
p 79	N83-21634		p 115	N83-19197		p 118	N83-19862
p 80	N83-21637		p 123	N83-20337	DE-FC01-80CS-40335	p 32	N83-21578
p 135	N83-21661	DE-AC18-81FC-10291	p 95	N83-16439	DE-FC02-80CS-30584	p 33	N83-21616
p 81	N83-22599	DE-AC19-79BC-10106	p 99	N83-16839	DE-FC02-80ET-14759	p 97	N83-16559
p 81	N83-22774		p 115	N83-19198	DE-FC03-77CS-31499	p 75	N83-21555
p 82	N83-22776	DE-AC20-80LC-10417	p 122	N83-19998	DE-FC03-79ET-27135	p 110	N83-18066
p 82	N83-22777	DE-AC21-78MC-08386	p 108	N83-18013		p 147	N83-22826
p 187	N83-22786	DE-AC21-79MC-12735	p 90	N83-22352	DE-FC03-80RA-50075	p 17	N83-18064
p 82	N83-22796	DE-AC21-80MC-14380	p 119	N83-19868		p 17	N83-18065
p 82	N83-22797		p 119	N83-19869		p 31	N83-21545
p 36	N83-22801	DE-AC21-80MC-14591	p 103	N83-17645	DE-FC03-80RA-50076	p 135	N83-21641
p 84	N83-22819	DE-AC21-81MC-16024	p 138	N83-22357	DE-FC05-77ET-10069	p 117	N83-19827
p 84	N83-22822	DE-AC21-81MC-16026	p 139	N83-22358	DE-FC07-79ET-27034	p 116	N83-19299
p 84	N83-22830	DE-AC21-81MC-16220	p 167	N83-18084	DE-FC07-79RA-23211	p 182	N83-22780
p 198	N83-22834		p 183	N83-22787	DE-FC07-80ID-12204	p 175	N83-20413
p 180	N83-21602	DE-AC21-81MC-16242	p 163	N83-16864	DE-FG01-79CS-20232	p 179	N83-21577
p 80	N83-21642	DE-AC21-81MC-16481	p 112	N83-18325	DE-FG01-79CS-20233	p 28	N83-20435
p 68	N83-20384		p 112	N83-18326	DE-FG01-79CS-20291	p 145	N83-22769
p 77	N83-21583		p 112	N83-18327	DE-FG01-79CS-50020	p 104	N83-17670
p 104	N83-17657		p 113	N83-18328	DE-FG01-80RA-50091	p 35	N83-22782
p 107	N83-17743		p 113	N83-18329	DE-FG01-81FE-05110	p 108	N83-18007
p 106	N83-17732	DE-AC21-81MC-18668	p 138	N83-22356	DE-FG01-81RA-50381	p 119	N83-19872
p 133	N83-21581	DE-AC21-82MC-19331	p 128	N83-21088		p 119	N83-19873
p 161	A83-29013	DE-AC22-76ET-10144	p 126	N83-21077		p 120	N83-19874
p 127	N83-21086	DE-AC22-76ET-10154	p 137	N83-22337	DE-FG02-77CS-34103	p 71	N83-20410
p 89	N83-21183		p 137	N83-22339	DE-FG02-79ER-10546	p 191	A83-28941
p 146	N83-22803	DE-AC22-76ET-10495	p 126	N83-21068	DE-FG02-80CS-83101	p 37	A83-19885
p 124	N83-20414	DE-AC22-76ET-10518	p 127	N83-21078	DE-FG02-80RS-10222	p 102	N83-17051
p 191	A83-27311	DE-AC22-77ET-11313	p 103	N83-17646	DE-FG02-81AF-92006	p 65	N83-19285
p 162	N83-16557	DE-AC22-78ET-10742	p 138	N83-22355	DE-FG02-81R5-10296	p 122	N83-19944
p 98	N83-16835	DE-AC22-79ET-14700	p 119	N83-19870	DE-FG02-81CS-30634	p 70	N83-20401
p 99	N83-16866	DE-AC22-79ET-14881	p 105	N83-17677	DE-FG02-81R5-10296	p 75	N83-21557
p 100	N83-16887	DE-AC22-80PC-30013	p 118	N83-19860	DE-FG02-81R5-10298	p 81	N83-22567
p 100	N83-16905	DE-AC22-80PC-30018	p 127	N83-21085	DE-FG02-81R5-10316	p 141	N83-22462
p 10	N83-16973	DE-AC22-80PC-30142	p 118	N83-19854	DE-FG03-79CS-30284	p 68	N83-20381
p 101	N83-17023	DE-AC22-80PC-30185	p 106	N83-17736	DE-FG04-77CS-34155	p 58	N83-16916
p 102	N83-17024	DE-AC22-80PC-30291	p 95	N83-16445	DE-FG06-79ET-27256	p 133	N83-21589
p 165	N83-17026	DE-AC22-80PC-30300	p 140	N83-22367		p 134	N83-21590
p 102	N83-17027	DE-AC22-80PC-30301	p 103	N83-17641		p 134	N83-21592
p 102	N83-17028	DE-AC22-80PC-30302	p 118	N83-19858		p 32	N83-21593
p 106	N83-17734	DE-AC22-81PC-10442	p 97	N83-16562		p 134	N83-21594
p 106	N83-17739	DE-AC22-81PC-30019	p 121	N83-19940		p 134	N83-21595
p 108	N83-18005	DE-AC22-81PC-40278	p 96	N83-16549	DE-FG07-81ID-12274	p 129	N83-21173
p 108	N83-18009	DE-AC22-81PC-40785	p 138	N83-22354		p 132	N83-21531
p 109	N83-18015	DE-AC22-81PC-42268	p 113	N83-18416		p 132	N83-21532
p 194	N83-18045	DE-AC22-82PC-50041	p 137	N83-22342		p 132	N83-21533
p 110	N83-18047	DE-AI01-71ET-13111	p 144	N83-22754		p 133	N83-21534
p 61	N83-18053	DE-AI01-76CS-31020	p 58	N83-16911		p 133	N83-21535
p 16	N83-18054	DE-AI01-76ET-12548	p 114	N83-19183	DE-FG07-81ID-12325	p 145	N83-22793
p 110	N83-18057	DE-AI01-76ET-20320	p 163	N83-16857	DE-FG07-81ID-12329	p 114	N83-19101
p 110	N83-18058		p 177	N83-21508	DE-FG07-81RA-50338	p 147	N83-22829
p 17	N83-18067		p 178	N83-21509	DE-FG22-80PC-30216	p 102	N83-17639
p 62	N83-18491		p 181	N83-22740	DE-FG22-80PC-30219	p 104	N83-17655

CONTRACT NUMBER INDEX

W-7405-ENG-26

DE-FG22-80PC-30230	p 102	N83-17638		p 197	N83-22759		p 45	A83-27131
DE-FG22-80PC-30231	p 111	N83-18101	EPRI PROJ 1086-9	p 103	N83-17647		p 63	N83-19215
DE-FG22-80PC-30249	p 148	N83-23190	EPRI PROJ 1108-1-4	p 121	N83-19943		p 115	N83-19216
DE-FG22-80PC-30306	p 29	N83-20457	EPRI PROJ 1192-1	p 75	N83-21558		p 115	N83-19217
DE-FG22-81PC-40781	p 139	N83-22363		p 187	N83-22788		p 187	N83-20155
DE-FG22-81PC-40782	p 118	N83-19853	EPRI PROJ 1199-11	p 198	N83-22836	NAS7-918	p 114	N83-19183
	p 126	N83-21071	EPRI PROJ 1219-3	p 187	N83-20399		p 81	N83-22741
DE-FG22-81PC-40783	p 95	N83-16446		p 187	N83-20400		p 81	N83-22742
DE-FG22-81PC-42294	p 97	N83-16561	EPRI PROJ 1234-1-2	p 137	N83-22339	NAS8-32093	p 74	N83-21530
DE-FG44-78CS-60055	p 32	N83-21561	EPRI PROJ 1270-1	p 177	N83-21366	NAS8-33198	p 46	A83-27147
DEN3-129	p 169	N83-19226	EPRI PROJ 1275-1	p 193	N83-16919	NAS8-34214	p 49	A83-27254
	p 170	N83-19244	EPRI PROJ 128-6	p 193	N83-16918		p 67	N83-20360
DEN3-136	p 182	N83-22748	EPRI PROJ 1317-1	p 23	N83-19334	NAS9-16126	p 73	N83-21512
DEN3-153	p 152	A83-24721	EPRI PROJ 1341-1	p 8	N83-16954	NA79RA-C-00104	p 29	N83-20511
	p 162	A83-29897	EPRI PROJ 1398-7	p 162	N83-16515	NBS-79-3534	p 59	N83-16940
DEN3-163	p 163	N83-16859	EPRI PROJ 1412-11	p 97	N83-16560	NCC2-163	p 96	N83-16543
DEN3-167	p 166	N83-17424	EPRI PROJ 1412-6	p 95	N83-16444	NCC2-164	p 94	N83-16417
DEN3-175	p 143	N83-22750	EPRI PROJ 1412-9	p 139	N83-22361	NE-5061-452	p 167	N83-18028
	p 143	N83-22751	EPRI PROJ 1433-1	p 113	N83-18554	NGL-34-001-001	p 20	N83-19227
	p 144	N83-22754	EPRI PROJ 1509-1	p 59	N83-16920	NR PROJ 097-411	p 175	N83-20054
DEN3-177	p 158	A83-27288	EPRI PROJ 1940-1	p 66	N83-19330	NRC OSU-80-00043	p 190	A83-27306
DEN3-182	p 181	N83-22746	EPRI PROJ 1975-1	p 79	N83-21627		p 190	A83-27307
DEN3-202	p 169	N83-19228		p 82	N83-22791		p 190	A83-27308
DEN3-251	p 194	N83-20359	EPRI PROJ 1995-1	p 78	N83-21618	NSERC-A-0440	p 190	A83-27306
DEN3-51	p 151	A83-23134	EPRI PROJ 475-9	p 67	N83-20298		p 190	A83-27307
DEN3-83	p 152	A83-25270	EPRI PROJ 875-1-8	p 27	N83-20433		p 190	A83-27308
DI-BM-H0-377072	p 114	N83-19078	EPRI PROJ 985	p 139	N83-22362	NSERC-A-7516	p 190	A83-27306
DI-BM-J0-205059	p 200	N83-19315	ER-78-84-4266	p 44	A83-25535		p 190	A83-27307
DI-MS-G1-106002	p 181	N83-22404	ESA-4623/81/NL-PP(SC)	p 73	N83-21513	NSERC-E-5370	p 190	A83-27308
DI-14-08-001-G-137	p 145	N83-22790	ESTEC-3662/78/NL-HP	p 192	N83-16869	NSERC-E-5373	p 190	A83-27306
DI-14-16-0009-81-063	p 28	N83-20455	ET-78-C-01-2159	p 194	N83-18074		p 190	A83-27307
DI-14-34-0001-1403	p 140	N83-22380		p 34	N83-21651	NSF AER-72-03487	p 161	A83-28956
DI-9-07-70-S0104	p 150	A83-20802	ET-78-C-01-3117	p 99	N83-16839	NSF DMR-79-23257	p 72	N83-20802
DOE-1250-C-410-0082	p 83	N83-22808	ET-78-C-08-1557	p 117	N83-19829	NSF ECS-80-03547	p 43	A83-24761
DOT-FA79WA-4310	p 92	A83-24035	EX-76-A-01-2295	p 181	N83-22607	NSF ODP-81-04383	p 114	N83-18964
	p 120	N83-19922	EX-76-C-01-1806	p 126	N83-21068	NSF PRM-81-83080	p 33	N83-21619
DOT-FH-11-9360	p 148	N83-22949	EX-76-C-01-2034	p 126	N83-21077	NSF-81-SP-1151	p 128	N83-21091
DOT-HS-9-02110	p 5	N83-16766	EX-76-C-01-2044	p 137	N83-22339	NSG-1514	p 167	N83-18024
DOT-HS-9-02111	p 30	N83-20844	EX-76-C-01-2270	p 161	A83-28956	NSG-1568	p 60	N83-17871
DOT-HS-9-02119	p 30	N83-20845	EX-76-C-01-2341	p 177	N83-21246	NSG-3122	p 114	N83-18924
DOT-UMTA-MN-11-0004	p 21	N83-19304		p 151	A83-23128	NSG-3249	p 117	N83-19812
	p 21	N83-19305	EY-76-C-05-5135	p 94	N83-16353	NSG-3303	p 177	N83-21508
DOT-UMTA-VA-06-0087	p 11	N83-17428	FAA PROJ 081-502-580	p 191	A83-28969		p 178	N83-21509
E(49-18)-2295	p 181	N83-22484	F33615-77-C-2059	p 195	N83-20375		p 181	N83-22740
EA-77-A-01-6010	p 22	N83-19306		p 129	N83-21169	N00014-75-C-0192	p 8	N83-16953
EC-77-S-2-4428	p 15	N83-18036	F33615-78-C-2001	p 30	N83-21168	N00014-77-C-0229	p 64	N83-19276
ECC-153-77-9-ESB	p 41	A83-22913	F33615-80-C-0512	p 15	N83-18035	N00014-80-C-0476	p 175	N83-20054
EF-77-C-012434	p 121	N83-19941	F33615-80-K-3626	p 194	N83-19277	N00014-81-C-0045	p 176	N83-20781
EF-77-C-03-1556	p 105	N83-17726	F33615-81-C-2024	p 90	A83-19847		p 176	N83-20782
EG-77-A-03-1499	p 75	N83-21555	F49620-77-C-0029	p 163	N83-16861	N68355-81-C-0502	p 192	N83-16860
EG-77-C-01-4042	p 56	N83-16881	F49620-82-C-0008	p 165	N83-16944	PNL-B-B6618-AN	p 116	N83-19250
	p 57	N83-16900	GRI-5011-341-0149	p 8	N83-16947	SERC-GR/B/23595	p 157	A83-27284
	p 60	N83-17723	GRI-5011-342-009	p 164	N83-16932		p 158	A83-27290
	p 13	N83-17824	GRI-5080-341-0344	p 55	N83-16710	SNSF-2,841,080	p 45	A83-26061
	p 61	N83-18046	GRI-5080-343-0441	p 22	N83-19314	TENRAC PROJ 80-B-1-1	p 146	N83-22807
	p 61	N83-18059	GRI-5081-346-0455	p 85	N83-22843	TENRAC PROJ 80-B-4-4A	p 141	N83-22646
	p 113	N83-18875	IAA-H54-81	p 115	N83-19217	TENRAC PROJ 80-S-1-3	p 83	N83-22809
	p 70	N83-20404	JPL PROJ 65096	p 63	N83-19219	W-31-109-ENG-38	p 149	A83-19884
	p 71	N83-20409	JPL PROJ 65906	p 159	A83-27298		p 10	N83-16976
	p 124	N83-20418	JPL-955009	p 63	N83-19221		p 17	N83-18060
	p 129	N83-21176	JPL-955909	p 63	N83-19215		p 111	N83-18075
	p 31	N83-21543	JPL-955926	p 185	A83-27127		p 23	N83-19331
	p 178	N83-21548	JPL-955935	p 63	N83-19222		p 124	N83-20406
	p 134	N83-21596	JPL-955986	p 81	N83-22741		p 130	N83-21494
	p 32	N83-21597	JPL-956020	p 81	N83-22742		p 132	N83-21524
	p 179	N83-21599	JPL-956042	p 81	N83-22744		p 31	N83-21538
	p 180	N83-21601	JPL-956046	p 63	N83-19220		p 79	N83-21635
	p 79	N83-21620	JPL-956205	p 115	N83-19216	W-7405-ENG-26	p 190	A83-27310
	p 182	N83-22783	JPL-956210	p 115	N83-19217		p 87	A83-27333
	p 83	N83-22799		p 81	N83-22745		p 97	N83-16558
	p 83	N83-22814	JPL-956312	p 98	N83-16564		p 98	N83-16572
EG-77-C-4042	p 76	N83-21568	MA-80-SAC-01059	p 190	A83-27309		p 192	N83-16862
EPA-CR-804811	p 96	N83-16460	MDA903-82-C-0028	p 190	A83-27309		p 192	N83-16863
EPA-R-802724	p 113	N83-18880	MDA903-82-K-0058	p 178	N83-21511		p 192	N83-16875
EPA-R-803971	p 165	N83-16935	MIPR-N-82-52	p 4	N83-16329		p 5	N83-16876
EPA-68-02-3110	p 113	N83-18883	NAG1-203	p 46	A83-27138		p 163	N83-16880
EPA-68-02-3122	p 152	A83-25270	NAG3-16	p 93	A83-25268		p 5	N83-16884
EPA-68-02-3171	p 23	N83-19356	NAG3-1	p 67	N83-20362		p 6	N83-16886
	p 29	N83-20459	NAG3-321	p 177	N83-21056		p 6	N83-16924
	p 29	N83-20469	NAG3-66	p 102	N83-17414		p 9	N83-16959
EPA-68-02-3669	p 22	N83-19313	NASW-3358	p 96	N83-16525		p 9	N83-16972
EPA-68-03-2884	p 149	N83-23249	NASW-3542	p 163	N83-16855		p 10	N83-16977
EPA-68-03-3024	p 36	N83-22867		p 159	A83-27298		p 10	N83-17067
EPA-68-03-3073	p 149	N83-23249	NAS3-20270	p 4	N83-16341		p 89	N83-17668
EPA-79-D-X0826	p 23	N83-19420	NAS3-20643	p 174	N83-19273		p 105	N83-17708
EPA-81-DX-0511	p 2	A83-24279	NAS3-21274	p 88	N83-16493		p 14	N83-17847
EPRI PROJ RP-1234-1-2	p 137	N83-22337	NAS3-21945	p 149	A83-20576		p 109	N83-18016
EPRI PROJ RP-1520-1	p 116	N83-19240	NAS3-22223	p 181	N83-22739		p 17	N83-18055
EPRI PROJ RP-559	p 105	N83-17707	NAS3-22230	p 105	N83-17728		p 61	N83-18056
EPRI PROJ TPS-81-781	p 101	N83-16913	NAS3-22232	p 81	N83-22756		p 62	N83-18069
EPRI PROJ WS-81-197	p 110	N83-18052	NAS3-22511	p 162	N83-16343		p 167	N83-18079
EPRI PROJ 1081-2	p 196	N83-21580	NAS3-22656	p 186	N83-16630		p 111	N83-18082
EPRI PROJ 1081-3	p 192	N83-16869	NAS3-23037	p 185	A83-27127		p 111	N83-18083
	p 194	N83-18074	NAS3-23155					
	p 197	N83-22758	NAS7-100					

W-7405-ENG-36

W-7405-ENG-48

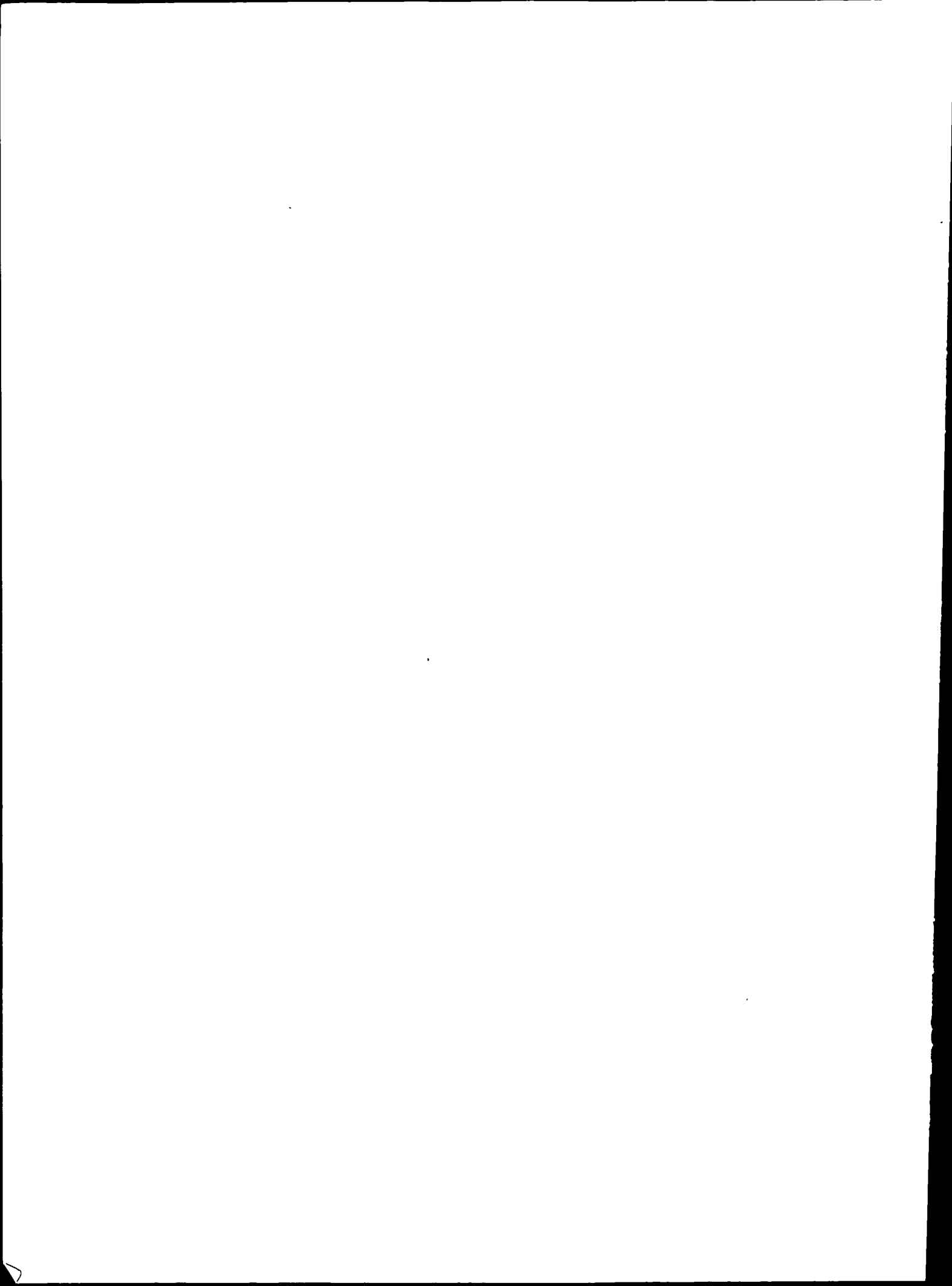
p 111	N83-18085		p 182	N83-22771
p 18	N83-18104		p 182	N83-22772
p 19	N83-18467		p 182	N83-22773
p 173	N83-19269		p 183	N83-22810
p 22	N83-19329		p 183	N83-22820
p 122	N83-19945		p 146	N83-22821
p 186	N83-20060		p 184	N83-23243
p 68	N83-20377		p 198	N83-23244
p 26	N83-20379	W-7405-ENG-82	p 124	N83-20383
p 27	N83-20423		p 181	N83-22404
p 27	N83-20431	WF41461400	p 192	N83-16860
p 195	N83-20432	XH-9-8073-1	p 153	A83-25688
p 28	N83-20456	XH-9-8217-1	p 44	A83-25534
p 177	N83-21075	XJ-0-9079	p 40	A83-22909
p 126	N83-21076	XP-9-8081-1	p 50	A83-27260
p 127	N83-21083	505-31-42	p 105	N83-17728
p 128	N83-21089		p 120	N83-18920
p 73	N83-21518	505-32-32	p 114	N83-18924
p 131	N83-21519	505-40-62	p 140	N83-22442
p 132	N83-21529	506-53-53-07	p 187	N83-22541
p 179	N83-21571	506-55-13-03	p 167	N83-18024
p 32	N83-21572	506-55-22	p 177	N83-21056
p 33	N83-21611	506-55-52	p 166	N83-18022
p 79	N83-21626	776-33-41	p 163	N83-16857
p 33	N83-21630		p 177	N83-21508
p 139	N83-22360		p 181	N83-22747
p 80	N83-22407	776-36-06	p 182	N83-22749
p 35	N83-22702	776-72-41	p 194	N83-20359
p 183	N83-22817	778-11-05	p 169	N83-19228
p 36	N83-22828		p 117	N83-19812
p 56	N83-16888	778-11-06	p 123	N83-20361
p 7	N83-16925	778-32-01	p 24	N83-19651
p 59	N83-16927	778-35-03	p 166	N83-17423
p 9	N83-16971	778-46-22	p 181	N83-22739
p 101	N83-17000			
p 104	N83-17652			
p 107	N83-17742			
p 108	N83-18010			
p 108	N83-18014			
p 16	N83-18040			
p 16	N83-18042			
p 61	N83-18050			
p 17	N83-18076			
p 18	N83-18080			
p 18	N83-18100			
p 168	N83-18512			
p 194	N83-18591			
p 22	N83-19328			
p 31	N83-21201			
p 130	N83-21496			
p 179	N83-21550			
p 135	N83-21636			
p 136	N83-21703			
p 136	N83-21828			
p 139	N83-22366			
p 145	N83-22775			
p 35	N83-22800			
p 198	N83-22837			
p 148	N83-23138			
p 184	N83-23146			
p 148	N83-23147			
p 98	N83-16563			
p 99	N83-16837			
p 99	N83-16841			
p 6	N83-16885			
p 164	N83-16922			
p 8	N83-16955			
p 8	N83-16956			
p 9	N83-16961			
p 9	N83-16964			
p 165	N83-17330			
p 103	N83-17651			
p 107	N83-17741			
p 13	N83-17750			
p 14	N83-17886			
p 14	N83-17889			
p 18	N83-18081			
p 19	N83-18118			
p 19	N83-18133			
p 20	N83-18963			
p 23	N83-19333			
p 23	N83-19420			
p 174	N83-19615			
p 66	N83-19627			
p 175	N83-20114			
p 124	N83-20414			
p 176	N83-20422			
p 195	N83-20430			
p 176	N83-20770			
p 29	N83-20842			
p 196	N83-21574			
p 133	N83-21587			
p 180	N83-21623			
p 196	N83-21629			
p 180	N83-22030			
p 142	N83-22466			

JULY 1983

CONF-811208-4

REPORT NUMBER INDEX

CONF-811208-4	p 18	N83-18104	#	DE82-000106	p 192	N83-16862	#	DE82-006792	p 61	N83-18056	#
CONF-811212-10	p 89	N83-17740	#	DE82-000264	p 14	N83-17886	#	DE82-006818	p 106	N83-17737	#
CONF-811212-11	p 110	N83-18047	#	DE82-000662	p 58	N83-16908	#	DE82-006822	p 17	N83-18055	#
CONF-811212-12	p 61	N83-18049	#	DE82-000850	p 103	N83-17645	#	DE82-006877	p 65	N83-19286	#
CONF-811212-13	p 16	N83-18054	#	DE82-001077	p 100	N83-16907	#	DE82-006887	p 112	N83-18137	#
CONF-811212-1	p 9	N83-16971	#	DE82-001251	p 192	N83-16869	#	DE82-006897	p 15	N83-18036	#
CONF-811212-2	p 194	N83-18591	#	DE82-002064	p 60	N83-18043	#	DE82-006912	p 102	N83-17051	#
CONF-811212-4	p 98	N83-16834	#	DE82-002371	p 194	N83-18591	#	DE82-006932	p 61	N83-18049	#
CONF-811212-5	p 163	N83-16880	#	DE82-002500	p 163	N83-16864	#	DE82-006933	p 89	N83-17740	#
CONF-811212-7	p 16	N83-18042	#	DE82-002592	p 168	N83-18511	#	DE82-006963	p 164	N83-16883	#
CONF-811212-8	p 16	N83-18040	#	DE82-002637	p 9	N83-16971	#	DE82-006987	p 23	N83-19331	#
CONF-811217-1	p 5	N83-16876	#	DE82-002686	p 103	N83-17646	#	DE82-006988	p 107	N83-17852	#
CONF-811220-1	p 97	N83-16553	#	DE82-002814	p 5	N83-16884	#	DE82-006998	p 63	N83-19136	#
CONF-811222-1	p 17	N83-18055	#	DE82-002918	p 9	N83-16959	#	DE82-007006	p 102	N83-17638	#
CONF-811224-1	p 61	N83-18056	#	DE82-003045	p 6	N83-16885	#	DE82-007019	p 105	N83-17726	#
CONF-811228-1	p 168	N83-18512	#	DE82-003277	p 199	N83-16892	#	DE82-007055	p 64	N83-19280	#
CONF-811267-SUMM	p 36	N83-22816	#	DE82-003278	p 199	N83-16891	#	DE82-007072	p 62	N83-18491	#
CONF-820102-1	p 56	N83-16878	#	DE82-003352	p 96	N83-16549	#	DE82-007074	p 144	N83-22760	#
CONF-820106-6	p 62	N83-18069	#	DE82-003711	p 9	N83-16964	#	DE82-007121	p 111	N83-18085	#
CONF-820107-2	p 165	N83-17330	#	DE82-003974	p 89	N83-17668	#	DE82-007127	p 22	N83-19329	#
CONF-820107-3	p 61	N83-18050	#	DE82-004052	p 109	N83-18016	#	DE82-007164	p 88	N83-17633	#
CONF-820107-5	p 62	N83-18491	#	DE82-004132	p 5	N83-16777	#	DE82-007469	p 139	N83-22360	#
CONF-820112-1	p 61	N83-18046	#	DE82-004258	p 16	N83-18051	#	DE82-007496	p 111	N83-18082	#
CONF-820112-4	p 186	N83-20060	#	DE82-004272	p 102	N83-17024	#	DE82-007502	p 111	N83-18083	#
CONF-820112-6	p 68	N83-20377	#	DE82-004485	p 95	N83-16429	#	DE82-007514	p 118	N83-19854	#
CONF-820112-8	p 14	N83-17847	#	DE82-004501	p 56	N83-16882	#	DE82-007554	p 72	N83-20768	#
CONF-820118-6	p 35	N83-22800	#	DE82-004555	p 97	N83-16558	#	DE82-007594	p 17	N83-18065	#
CONF-820122-2	p 108	N83-18014	#	DE82-004662	p 56	N83-16881	#	DE82-007596	p 104	N83-17676	#
CONF-820127-2	p 107	N83-17754	#	DE82-004670	p 6	N83-16886	#	DE82-007602	p 17	N83-18064	#
CONF-820202-2	p 60	N83-18043	#	DE82-004677	p 101	N83-17000	#	DE82-007648	p 61	N83-18044	#
CONF-820203-1	p 14	N83-17886	#	DE82-004731	p 99	N83-16837	#	DE82-007670	p 103	N83-17640	#
CONF-820203-2	p 14	N83-17889	#	DE82-004737	p 100	N83-16887	#	DE82-007721	p 19	N83-18467	#
CONF-820205-2	p 108	N83-18010	#	DE82-004797	p 56	N83-16877	#	DE82-007751	p 99	N83-16841	#
CONF-820205-3	p 104	N83-17661	#	DE82-004798	p 55	N83-16688	#	DE82-007774	p 60	N83-17723	#
CONF-820215-2	p 186	N83-18102	#	DE82-004806	p 88	N83-17323	#	DE82-007816	p 110	N83-18061	#
CONF-820217-1	p 174	N83-19615	#	DE82-004822	p 8	N83-16956	#	DE82-007839	p 16	N83-18039	#
CONF-820217-2	p 17	N83-18067	#	DE82-004825	p 8	N83-16955	#	DE82-007880	p 18	N83-18100	#
CONF-820219-2	p 10	N83-16977	#	DE82-004840	p 20	N83-18963	#	DE82-007911	p 179	N83-21577	#
CONF-820219-4	p 35	N83-22702	#	DE82-004879	p 99	N83-16839	#	DE82-007916	p 174	N83-19595	#
CONF-820248-1	p 130	N83-21328	#	DE82-004925	p 13	N83-17750	#	DE82-007934	p 77	N83-21582	#
CONF-820304-16-DRAFT	p 28	N83-20456	#	DE82-004932	p 98	N83-16834	#	DE82-007971	p 65	N83-19285	#
CONF-820304-2	p 103	N83-17645	#	DE82-004954	p 9	N83-16961	#	DE82-008088	p 10	N83-16976	#
CONF-820304-7	p 103	N83-17646	#	DE82-005117	p 106	N83-17732	#	DE82-008106	p 145	N83-22775	#
CONF-820316-1	p 100	N83-16906	#	DE82-005122	p 64	N83-19281	#	DE82-008108	p 7	N83-16925	#
CONF-820323-1	p 113	N83-18464	#	DE82-005156	p 108	N83-18007	#	DE82-008134	p 6	N83-16924	#
CONF-820393	p 147	N83-22825	#	DE82-005196	p 10	N83-17067	#	DE82-008136	p 19	N83-18109	#
CONF-820409-2	p 104	N83-17652	#	DE82-005198	p 163	N83-16880	#	DE82-008173	p 108	N83-18010	#
CONF-820410-8	p 21	N83-19290	#	DE82-005199	p 18	N83-18104	#	DE82-008323	p 137	N83-22339	#
CONF-820423-1	p 32	N83-21597	#	DE82-005201	p 5	N83-16876	#	DE82-008386	p 127	N83-21079	#
CONF-820491-VOL-1	p 135	N83-21628	#	DE82-005212	p 6	N83-16903	#	DE82-008487	p 70	N83-20398	#
CONF-82051-2	p 36	N83-22802	#	DE82-005226	p 101	N83-17023	#	DE82-008581	p 17	N83-18067	#
CONF-820519-1	p 106	N83-17736	#	DE82-005228	p 100	N83-16905	#	DE82-008607	p 104	N83-17661	#
CONF-820524-3	p 145	N83-22775	#	DE82-005504	p 186	N83-17342	#	DE82-008679	p 113	N83-18416	#
CONF-820528-5	p 175	N83-20114	#	DE82-005507	p 56	N83-16879	#	DE82-008695	p 109	N83-18015	#
CONF-820531-1	p 29	N83-20842	#	DE82-005508	p 5	N83-16569	#	DE82-008705	p 140	N83-22436	#
CONF-820555-1	p 69	N83-20393	#	DE82-005521	p 16	N83-18041	#	DE82-008776	p 19	N83-18555	#
CONF-820555-4	p 68	N83-20387	#	DE82-005591	p 8	N83-16954	#	DE82-008833	p 62	N83-18069	#
CONF-820555-5	p 83	N83-22814	#	DE82-005641	p 12	N83-17673	#	DE82-008853	p 198	N83-22837	#
CONF-820580-1	p 124	N83-20414	#	DE82-005659	p 108	N83-18009	#	DE82-008957	p 179	N83-21591	#
CONF-820605-20	p 89	N83-22349	#	DE82-005667	p 162	N83-16556	#	DE82-009007	p 110	N83-18070	#
CONF-820605-21	p 90	N83-22813	#	DE82-005696	p 174	N83-19282	#	DE82-009121	p 110	N83-18066	#
CONF-820612-4	p 120	N83-19876	#	DE82-005698	p 165	N83-17330	#	DE82-009139	p 32	N83-21597	#
CONF-820618-4	p 176	N83-20770	#	DE82-005727	p 165	N83-17325	#	DE82-009159	p 7	N83-16926	#
CONF-820629-12	p 84	N83-22831	#	DE82-005748	p 200	N83-20821	#	DE82-009174	p 124	N83-20395	#
CONF-820629-8	p 31	N83-21201	#	DE82-005767	p 66	N83-19627	#	DE82-009176	p 89	N83-21183	#
CONF-820629-9	p 68	N83-20388	#	DE82-005769	p 62	N83-18062	#	DE82-009310	p 120	N83-19879	#
CONF-820712-1	p 120	N83-19877	#	DE82-005791	p 113	N83-18875	#	DE82-009320	p 76	N83-21562	#
CONF-820814-35	p 197	N83-22804	#	DE82-005798	p 61	N83-18053	#	DE82-009349	p 69	N83-20394	#
CONF-820827-11	p 195	N83-20432	#	DE82-005804	p 110	N83-18047	#	DE82-009395	p 146	N83-22803	#
CONF-820827-28	p 198	N83-22806	#	DE82-005824	p 19	N83-18118	#	DE82-009462	p 98	N83-16563	#
CONF-820969-2	p 198	N83-22805	#	DE82-005828	p 36	N83-22802	#	DE82-009473	p 18	N83-18077	#
CONF-821033-1	p 198	N83-22815	#	DE82-005840	p 14	N83-17889	#	DE82-009503	p 66	N83-19303	#
CONF-821036-1	p 138	N83-22351	#	DE82-005854	p 65	N83-19287	#	DE82-009515	p 104	N83-17655	#
CONF-821055-1	p 183	N83-22817	#	DE82-005855	p 23	N83-19333	#	DE82-009539	p 17	N83-18076	#
CONF-821106-9	p 146	N83-22823	#	DE82-005864	p 117	N83-19302	#	DE82-009586	p 17	N83-18068	#
COO-2533-13	p 176	N83-20421	#	DE82-005877	p 110	N83-18058	#	DE82-009595	p 120	N83-19874	#
CRA-591	p 16	N83-18051	#	DE82-005919	p 162	N83-16557	#	DE82-009596	p 119	N83-19873	#
CRREL-82-24	p 125	N83-20479	#	DE82-005931	p 98	N83-16835	#	DE82-009597	p 119	N83-19872	#
CS-2009-VOL-2	p 8	N83-16954	#	DE82-005951	p 166	N83-17331	#	DE82-009664	p 115	N83-19197	#
CSIR-ME-445	p 128	N83-21165	#	DE82-005988	p 16	N83-18054	#	DE82-009666	p 115	N83-19196	#
CSIR-ME-446	p 129	N83-21166	#	DE82-006026	p 194	N83-18045	#	DE82-009828	p 35	N83-22702	#
CSIR-S-313-VOL-2	p 37	N83-23212	#	DE82-006082	p 106	N83-17734	#	DE82-009866	p 148	N83-23190	#
DE-83-004474	p 8	N83-16954	#	DE82-006104	p 61	N83-18050	#	DE82-009931	p 137	N83-22337	#
DEB-TR-82-02	p 128	N83-21165	#	DE82-006115	p 108	N83-18005	#	DE82-009999	p 99	N83-16844	#
DE81-025437	p 128	N83-21166	#	DE82-006117	p 61	N83-18046	#	DE82-010061	p 107	N83-17743	#
DE81-030842	p 129	N83-21166	#	DE82-006118	p 61	N83-18059	#	DE82-010108	p 186	N83-18102	#
DE81-032010	p 37	N83-23212	#	DE82-006152	p 16	N83-18042	#	DE82-010161	p 100	N83-16906	#
	p 78	N83-21615	#	DE82-006153	p 16	N83-18040	#	DE82-010188	p 68	N83-20377	#
	p 78	N83-21615	#	DE82-006164	p 110	N83-18057	#	DE82-010194	p 14	N83-17847	#
	p 78	N83-21615	#	DE82-006173	p 106	N83-17739	#	DE82-010202	p 186	N83-20060	#
	p 178	N83-21511	#	DE82-006228	p 99	N83-16838	#	DE82-010264	p 124	N83-20415	#
	p 178	N83-21511	#	DE82-006272	p 164	N83-16904	#	DE82-010299	p 103	N83-17641	#
	p 26	N83-20379	#	DE82-006280	p 15	N83-18038	#	DE82-010302	p 118	N83-19858	#
	p 56	N83-16878	#	DE82-006289	p 164	N83-16901	#	DE82-010396	p 62	N83-18063	#
	p 192	N83-16863	#	DE82-006294	p 102	N83-17639	#	DE82-010417	p 104	N83-17652	#
				DE82-006746	p 107	N83-17742	#	DE82-010425	p 168	N83-18512	#



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N83-22821

ACCESSION NUMBER INDEX

N83-22821 # p 146
 N83-22822 # p 84
 N83-22823 # p 146
 N83-22824 # p 146
 N83-22825 # p 147
 N83-22826 # p 147
 N83-22827 # p 183
 N83-22828 # p 36
 N83-22829 # p 147
 N83-22830 # p 84
 N83-22831 # p 84
 N83-22832 # p 183
 N83-22834 # p 198
 N83-22836 # p 198
 N83-22837 # p 198
 N83-22838 # p 36
 N83-22839 # p 184
 N83-22840 # p 84
 N83-22841 # p 84
 N83-22842 # p 84
 N83-22843 # p 85
 N83-22844 # p 147
 N83-22845 # p 147
 N83-22846 # p 36
 N83-22856 # p 85
 N83-22867 # p 36
 N83-22896 # p 147
 N83-22903 # p 147
 N83-22904 # p 147
 N83-22949 # p 148
 N83-22960 # p 148
 N83-22962 # p 36
 N83-22977 # p 36
 N83-23138 # p 148
 N83-23146 # p 184
 N83-23147 # p 148
 N83-23173 # p 90
 N83-23190 # p 148
 N83-23208 # p 37
 N83-23212 # p 37
 N83-23213 # p 148
 N83-23214 # p 148
 N83-23215 # p 148
 N83-23243 # p 184
 N83-23244 # p 198
 N83-23245 # p 37
 N83-23249 # p 149
 N83-23250 # p 37
 N83-26442 # p 85

ACCESSION NUMBER INDEX

N83-22820

N83-19874 #	p 120	N83-20416 #	p 71	N83-21496 #	p 130	N83-21606 #	p 78	N83-22510 #	p 80
N83-19876 #	p 120	N83-20417 #	p 71	N83-21499 #	p 131	N83-21607 #	p 78	N83-22529 #	p 187
N83-19877 #	p 120	N83-20418 #	p 124	N83-21501 #	p 31	N83-21608 #	p 180	N83-22534 #	p 80
N83-19879 #	p 120	N83-20419 #	p 26	N83-21502 #	p 131	N83-21609 #	p 134	N83-22541 #	p 187
N83-19881 #	p 120	N83-20420 #	p 26	N83-21505 #	p 131	N83-21610 #	p 32	N83-22567 #	p 81
N83-19898 #	p 66	N83-20421 #	p 176	N83-21506 #	p 131	N83-21611 #	p 33	N83-22568 #	p 142
N83-19917 #	p 67	N83-20422 #	p 176	N83-21507 #	p 131	N83-21612 #	p 33	N83-22594 #	p 142
N83-19920 #	p 120	N83-20423 #	p 27	N83-21508 #	p 177	N83-21613 #	p 78	N83-22599 #	p 81
N83-19922 #	p 120	N83-20424 #	p 27	N83-21509 #	p 178	N83-21614 #	p 78	N83-22607 #	p 181
N83-19923 #	p 24	N83-20426 #	p 71	N83-21510 #	p 72	N83-21615 #	p 78	N83-22672 #	p 142
N83-19924 #	p 121	N83-20427 #	p 27	N83-21511 #	p 178	N83-21616 #	p 33	N83-22673 #	p 34
N83-19937 #	p 121	N83-20428 #	p 71	N83-21512 #	p 73	N83-21617 #	p 33	N83-22674 #	p 34
N83-19939 #	p 121	N83-20429 #	p 27	N83-21513 #	p 73	N83-21618 #	p 78	N83-22675 #	p 143
N83-19940 #	p 121	N83-20430 #	p 195	N83-21514 #	p 73	N83-21619 #	p 33	N83-22676 #	p 143
N83-19941 #	p 121	N83-20431 #	p 27	N83-21515 #	p 73	N83-21620 #	p 79	N83-22677 #	p 143
N83-19943 #	p 121	N83-20432 #	p 195	N83-21517 #	p 73	N83-21621 #	p 135	N83-22678 #	p 143
N83-19944 #	p 122	N83-20433 #	p 27	N83-21518 #	p 73	N83-21622 #	p 180	N83-22697 #	p 143
N83-19945 #	p 122	N83-20434 #	p 125	N83-21519 #	p 131	N83-21623 #	p 180	N83-22698 #	p 143
N83-19946 #	p 122	N83-20435 #	p 28	N83-21521 #	p 73	N83-21624 #	p 196	N83-22702 #	p 35
N83-19950 #	p 24	N83-20436 #	p 71	N83-21522 #	p 74	N83-21625 #	p 79	N83-22737 #	p 35
N83-19956 #	p 24	N83-20437 #	p 176	N83-21523 #	p 132	N83-21626 #	p 79	N83-22738 #	p 143
N83-19957 #	p 24	N83-20438 #	p 28	N83-21524 #	p 132	N83-21627 #	p 79	N83-22739 #	p 181
N83-19962 #	p 67	N83-20439 #	p 28	N83-21525 #	p 31	N83-21628 #	p 135	N83-22740 #	p 181
N83-19963 #	p 67	N83-20440 #	p 125	N83-21526 #	p 178	N83-21629 #	p 196	N83-22741 #	p 81
N83-19998 #	p 122	N83-20441 #	p 72	N83-21527 #	p 195	N83-21630 #	p 33	N83-22742 #	p 81
N83-20002 #	p 24	N83-20442 #	p 28	N83-21528 #	p 196	N83-21631 #	p 135	N83-22744 #	p 81
N83-20004 #	p 175	N83-20443 #	p 28	N83-21529 #	p 132	N83-21632 #	p 135	N83-22745 #	p 81
N83-20060 #	p 186	N83-20451 #	p 28	N83-21530 #	p 74	N83-21633 #	p 180	N83-22746 #	p 181
N83-20073 #	p 122	N83-20455 #	p 28	N83-21531 #	p 132	N83-21634 #	p 79	N83-22747 #	p 181
N83-20114 #	p 175	N83-20456 #	p 28	N83-21532 #	p 132	N83-21635 #	p 79	N83-22748 #	p 182
N83-20151 #	p 25	N83-20457 #	p 29	N83-21533 #	p 132	N83-21636 #	p 130	N83-22749 #	p 182
N83-20155 #	p 187	N83-20459 #	p 29	N83-21534 #	p 133	N83-21637 #	p 85	N83-22750 #	p 143
N83-20161 #	p 175	N83-20469 #	p 29	N83-21535 #	p 133	N83-21638 #	p 34	N83-22751 #	p 143
N83-20171 #	p 122	N83-20479 #	p 125	N83-21536 #	p 31	N83-21639 #	p 196	N83-22752 #	p 35
N83-20298 #	p 67	N83-20511 #	p 29	N83-21537 #	p 74	N83-21640 #	p 197	N83-22753 #	p 35
N83-20330 #	p 123	N83-20525 #	p 29	N83-21538 #	p 31	N83-21641 #	p 135	N83-22754 #	p 144
N83-20333 #	p 123	N83-20744 #	p 29	N83-21539 #	p 74	N83-21642 #	p 80	N83-22755 #	p 81
N83-20334 #	p 25	N83-20768 #	p 72	N83-21541 #	p 74	N83-21643 #	p 80	N83-22756 #	p 197
N83-20336 #	p 25	N83-20770 #	p 176	N83-21542 #	p 74	N83-21644 #	p 80	N83-22757 #	p 197
N83-20337 #	p 123	N83-20781 #	p 176	N83-21543 #	p 31	N83-21650 #	p 34	N83-22758 #	p 144
N83-20342 #	p 123	N83-20782 #	p 176	N83-21544 #	p 178	N83-21651 #	p 34	N83-22759 #	p 144
N83-20359 #	p 194	N83-20802 #	p 72	N83-21545 #	p 31	N83-21652 #	p 135	N83-22760 #	p 35
N83-20360 #	p 67	N83-20821 #	p 200	N83-21546 #	p 75	N83-21653 #	p 34	N83-22761 #	p 144
N83-20361 #	p 123	N83-20842 #	p 29	N83-21547 #	p 75	N83-21654 #	p 135	N83-22762 #	p 144
N83-20362 #	p 67	N83-20844 #	p 30	N83-21548 #	p 178	N83-21656 #	p 136	N83-22763 #	p 144
N83-20363 #	p 25	N83-20845 #	p 30	N83-21549 #	p 179	N83-21657 #	p 136	N83-22765 #	p 144
N83-20364 #	p 25	N83-20846 #	p 176	N83-21550 #	p 179	N83-21694 #	p 136	N83-22766 #	p 144
N83-20365 #	p 123	N83-21006 #	p 176	N83-21551 #	p 75	N83-21701 #	p 136	N83-22767 #	p 144
N83-20366 #	p 123	N83-21021 #	p 177	N83-21552 #	p 31	N83-21702 #	p 136	N83-22768 #	p 145
N83-20367 #	p 25	N83-21051 #	p 125	N83-21553 #	p 32	N83-21703 #	p 136	N83-22769 #	p 197
N83-20369 #	p 25	N83-21052 #	p 125	N83-21554 #	p 75	N83-21722 #	p 80	N83-22770 #	p 182
N83-20370 #	p 25	N83-21053 #	p 126	N83-21555 #	p 75	N83-21723 #	p 136	N83-22771 #	p 182
N83-20371 #	p 25	N83-21054 #	p 177	N83-21556 #	p 75	N83-21728 #	p 136	N83-22772 #	p 182
N83-20372 #	p 175	N83-21056 #	p 126	N83-21557 #	p 75	N83-21934 #	p 137	N83-22773 #	p 182
N83-20373 #	p 26	N83-21068 #	p 126	N83-21558 #	p 75	N83-22030 #	p 180	N83-22774 #	p 81
N83-20374 #	p 68	N83-21069 #	p 126	N83-21559 #	p 75	N83-22179 #	p 34	N83-22775 #	p 145
N83-20375 #	p 195	N83-21071 #	p 126	N83-21560 #	p 76	N83-22336 #	p 137	N83-22776 #	p 82
N83-20376 #	p 195	N83-21072 #	p 177	N83-21561 #	p 32	N83-22337 #	p 137	N83-22777 #	p 82
N83-20377 #	p 68	N83-21076 #	p 126	N83-21562 #	p 76	N83-22339 #	p 137	N83-22780 #	p 182
N83-20378 #	p 68	N83-21077 #	p 126	N83-21563 #	p 76	N83-22342 #	p 137	N83-22781 #	p 145
N83-20379 #	p 26	N83-21078 #	p 127	N83-21564 #	p 76	N83-22349 #	p 89	N83-22782 #	p 35
N83-20380 #	p 195	N83-21079 #	p 127	N83-21565 #	p 76	N83-22350 #	p 137	N83-22783 #	p 182
N83-20381 #	p 68	N83-21083 #	p 127	N83-21566 #	p 76	N83-22351 #	p 138	N83-22784 #	p 183
N83-20382 #	p 68	N83-21084 #	p 127	N83-21567 #	p 76	N83-22352 #	p 90	N83-22785 #	p 197
N83-20383 #	p 124	N83-21085 #	p 127	N83-21568 #	p 76	N83-22353 #	p 138	N83-22786 #	p 187
N83-20384 #	p 68	N83-21086 #	p 127	N83-21569 #	p 76	N83-22354 #	p 138	N83-22787 #	p 183
N83-20386 #	p 124	N83-21088 #	p 128	N83-21570 #	p 77	N83-22355 #	p 138	N83-22788 #	p 187
N83-20387 #	p 68	N83-21089 #	p 128	N83-21571 #	p 179	N83-22356 #	p 138	N83-22789 #	p 145
N83-20388 #	p 68	N83-21091 #	p 128	N83-21572 #	p 32	N83-22357 #	p 138	N83-22790 #	p 145
N83-20389 #	p 69	N83-21127 #	p 128	N83-21573 #	p 196	N83-22358 #	p 139	N83-22791 #	p 82
N83-20390 #	p 69	N83-21127 #	p 128	N83-21574 #	p 179	N83-22360 #	p 139	N83-22792 #	p 35
N83-20391 #	p 69	N83-21136 #	p 128	N83-21577 #	p 32	N83-22361 #	p 139	N83-22793 #	p 145
N83-20392 #	p 69	N83-21154 #	p 72	N83-21578 #	p 77	N83-22362 #	p 139	N83-22794 #	p 197
N83-20393 #	p 69	N83-21156 #	p 30	N83-21579 #	p 196	N83-22363 #	p 139	N83-22795 #	p 82
N83-20394 #	p 69	N83-21165 #	p 128	N83-21580 #	p 133	N83-22366 #	p 139	N83-22796 #	p 82
N83-20395 #	p 124	N83-21166 #	p 129	N83-21581 #	p 77	N83-22367 #	p 140	N83-22797 #	p 83
N83-20396 #	p 69	N83-21168 #	p 30	N83-21582 #	p 77	N83-22380 #	p 181	N83-22798 #	p 83
N83-20397 #	p 70	N83-21169 #	p 129	N83-21583 #	p 77	N83-22404 #	p 80	N83-22799 #	p 83
N83-20398 #	p 187	N83-21171 #	p 129	N83-21584 #	p 77	N83-22407 #	p 140	N83-22800 #	p 36
N83-20399 #	p 187	N83-21172 #	p 129	N83-21585 #	p 133	N83-22436 #	p 140	N83-22801 #	p 36
N83-20400 #	p 70	N83-21173 #	p 129	N83-21586 #	p 133	N83-22439 #	p 140	N83-22802 #	p 146
N83-20401 #	p 70	N83-21174 #	p 129	N83-21587 #	p 133	N83-22440 #	p 140	N83-22803 #	p 197
N83-20402 #	p 70	N83-21175 #	p 129	N83-21588 #	p 133	N83-22442 #	p 140	N83-22804 #	p 198
N83-20403 #	p 175	N83-21176 #	p 129	N83-21589 #	p 134	N83-22445 #	p 141	N83-22805 #	p 198
N83-20404 #	p 70	N83-21177 #	p 130	N83-21590 #	p 179	N83-22446 #	p 141	N83-22806 #	p 146
N83-20405 #	p 26	N83-21178 #	p 89	N83-21591 #	p 32	N83-22448 #	p 141	N83-22807 #	p 83
N83-20406 #	p 124	N83-21183 #	p 130	N83-21592 #	p 134	N83-22449 #	p 141	N83-22808 #	p 83
N83-20407 #	p 70	N83-21185 #	p 30	N83-21593 #	p 134	N83-22450 #	p 141	N83-22809 #	p 183
N83-20408 #	p 70	N83-21187 #	p 130	N83-21594 #	p 134	N83-22453 #	p 141	N83-22810 #	p 146
N83-20409 #	p 71	N83-21188 #	p 130	N83-21595 #	p 134	N83-22461 #	p 141	N83-22811 #	p 90
N83-20410 #	p 26	N83-21189 #	p 72	N83-21596 #	p 32	N83-22462 #	p 141	N83-22812 #	p 90
N83-20411 #	p 26	N83-21200 #	p 31	N83-21597 #	p 179	N83-22464 #	p 142	N83-22813 #	p 83
N83-20412 #	p 26	N83-21201 #	p 72	N83-21598 #	p 179	N83-22466 #	p 142	N83-22814 #	p 198
N83-20413 #	p 175	N83-21202 #	p 177	N83-21599 #	p 180	N83-22467 #	p 142	N83-22815 #	p 36
N83-20414 #	p 124	N83-21246 #	p 177	N83-21601 #	p 180	N83-22468 #	p 142	N83-22816 #	p 183
N83-20415 #	p 124	N83-21247 #	p 130	N83-21602 #	p 77	N83-22470 #	p 142	N83-22817 #	p 83
		N83-21248 #	p 177	N83-21603 #	p 78	N83-22480 #	p 200	N83-22818 #	p 84
		N83-21249 #	p 130	N83-21604 #	p 78	N83-22484 #	p 181	N83-22819 #	p 183
		N83-21250 #	p 130	N83-21605 #	p 78	N83-22486 #	p 34	N83-22820 #	p 183

N83-16653

N83-16653 # p 5
N83-16655 # p 5
N83-16688 # p 55
N83-16710 # p 55
N83-16753 # p 98
N83-16766 # p 5
N83-16777 # p 5
N83-16834 # p 98
N83-16835 # p 98
N83-16837 # p 99
N83-16838 # p 99
N83-16839 # p 99
N83-16841 # p 99
N83-16844 # p 99
N83-16855* # p 163
N83-16857* # p 163
N83-16858* # p 191
N83-16859* # p 163
N83-16860 # p 192
N83-16861 # p 163
N83-16862 # p 192
N83-16863 # p 192
N83-16864 # p 163
N83-16865 # p 99
N83-16866 # p 99
N83-16867 # p 163
N83-16868 # p 192
N83-16869 # p 192
N83-16870 # p 5
N83-16871 # p 55
N83-16872 # p 55
N83-16873 # p 55
N83-16874 # p 100
N83-16875 # p 192
N83-16876 # p 5
N83-16877 # p 56
N83-16878 # p 56
N83-16879 # p 56
N83-16880 # p 163
N83-16881 # p 56
N83-16882 # p 56
N83-16883 # p 164
N83-16884 # p 5
N83-16885 # p 6
N83-16886 # p 6
N83-16887 # p 100
N83-16888 # p 56
N83-16889 # p 56
N83-16890 # p 57
N83-16891 # p 199
N83-16892 # p 199
N83-16893 # p 100
N83-16894 # p 57
N83-16895 # p 57
N83-16896 # p 57
N83-16897 # p 57
N83-16898 # p 57
N83-16899 # p 192
N83-16900 # p 57
N83-16901 # p 164
N83-16902 # p 6
N83-16903 # p 6
N83-16904 # p 164
N83-16905 # p 100
N83-16906 # p 100
N83-16907 # p 100
N83-16908 # p 58
N83-16909 # p 58
N83-16910 # p 101
N83-16911 # p 58
N83-16913 # p 101
N83-16914 # p 58
N83-16915 # p 164
N83-16916 # p 58
N83-16917 # p 58
N83-16918 # p 193
N83-16919 # p 193
N83-16920 # p 59
N83-16921 # p 6
N83-16922 # p 164
N83-16923 # p 6
N83-16924 # p 6
N83-16925 # p 7
N83-16926 # p 7
N83-16927 # p 59
N83-16928 # p 101
N83-16929 # p 7
N83-16930 # p 7
N83-16932 # p 164
N83-16933 # p 193
N83-16934 # p 193
N83-16935 # p 165
N83-16936 # p 59
N83-16937 # p 165
N83-16938 # p 165
N83-16939 # p 59

N83-16940 # p 59
N83-16941 # p 165
N83-16942 # p 7
N83-16943 # p 7
N83-16944 # p 165
N83-16945 # p 8
N83-16946 # p 59
N83-16947 # p 8
N83-16948 # p 60
N83-16949 # p 193
N83-16950 # p 193
N83-16953 # p 8
N83-16954 # p 8
N83-16955 # p 8
N83-16956 # p 8
N83-16959 # p 9
N83-16961 # p 9
N83-16964 # p 9
N83-16971 # p 9
N83-16972 # p 9
N83-16973 # p 10
N83-16975 # p 101
N83-16976 # p 10
N83-16977 # p 10
N83-16979 # p 10
N83-16985 # p 10
N83-16986 # p 10
N83-16989* # p 101
N83-17000 # p 101
N83-17001 # p 60
N83-17023 # p 101
N83-17024 # p 102
N83-17026 # p 165
N83-17027 # p 102
N83-17028 # p 102
N83-17051 # p 102
N83-17067 # p 10
N83-17086 # p 11
N83-17323 # p 88
N83-17325 # p 165
N83-17330 # p 165
N83-17331 # p 166
N83-17342 # p 186
N83-17365* # p 11
N83-17414* # p 102
N83-17423* # p 166
N83-17424* # p 166
N83-17428 # p 11
N83-17455 # p 11
N83-17456 # p 11
N83-17458 # p 11
N83-17459 # p 11
N83-17460 # p 11
N83-17463 # p 12
N83-17464 # p 12
N83-17465 # p 12
N83-17466 # p 12
N83-17467 # p 12
N83-17468 # p 12
N83-17522 # p 166
N83-17633 # p 88
N83-17638 # p 102
N83-17639 # p 102
N83-17640 # p 103
N83-17641 # p 103
N83-17645 # p 103
N83-17646 # p 103
N83-17647 # p 103
N83-17651 # p 103
N83-17652 # p 104
N83-17655 # p 104
N83-17657 # p 104
N83-17661 # p 104
N83-17668 # p 89
N83-17670 # p 104
N83-17673 # p 12
N83-17676 # p 104
N83-17677 # p 105
N83-17678 # p 105
N83-17686 # p 199
N83-17707 # p 105
N83-17708 # p 105
N83-17723 # p 60
N83-17726 # p 105
N83-17728* # p 105
N83-17729 # p 106
N83-17731 # p 13
N83-17732 # p 106
N83-17734 # p 106
N83-17735 # p 106
N83-17736 # p 106
N83-17737 # p 106
N83-17739 # p 106
N83-17740 # p 89
N83-17741 # p 107
N83-17742 # p 107
N83-17743 # p 107

N83-17750 # p 13
N83-17754 # p 107
N83-17757 # p 89
N83-17758 # p 89
N83-17760 # p 199
N83-17761 # p 199
N83-17765 # p 107
N83-17824 # p 13
N83-17840 # p 13
N83-17841 # p 13
N83-17842 # p 14
N83-17852 # p 107
N83-17871* # p 60
N83-17886 # p 14
N83-17889 # p 14
N83-17905 # p 166
N83-17999 # p 107
N83-18005 # p 108
N83-18007 # p 108
N83-18008 # p 108
N83-18009 # p 108
N83-18010 # p 108
N83-18013 # p 108
N83-18014 # p 108
N83-18015 # p 109
N83-18016 # p 109
N83-18017 # p 14
N83-18018 # p 14
N83-18019 # p 14
N83-18020 # p 14
N83-18021 # p 14
N83-18022* # p 166
N83-18023* # p 60
N83-18024* # p 167
N83-18025* # p 60
N83-18026 # p 15
N83-18027 # p 15
N83-18028 # p 167
N83-18029 # p 109
N83-18030 # p 167
N83-18031 # p 109
N83-18032 # p 109
N83-18033 # p 186
N83-18034 # p 109
N83-18035 # p 15
N83-18036 # p 15
N83-18037 # p 15
N83-18038 # p 15
N83-18039 # p 16
N83-18040 # p 16
N83-18041 # p 16
N83-18042 # p 16
N83-18043 # p 60
N83-18044 # p 61
N83-18045 # p 194
N83-18046 # p 61
N83-18047 # p 110
N83-18049 # p 61
N83-18050 # p 61
N83-18051 # p 16
N83-18052 # p 110
N83-18053 # p 61
N83-18054 # p 16
N83-18055 # p 17
N83-18056 # p 61
N83-18057 # p 110
N83-18058 # p 110
N83-18059 # p 61
N83-18060 # p 17
N83-18061 # p 110
N83-18062 # p 62
N83-18063 # p 62
N83-18064 # p 17
N83-18065 # p 17
N83-18066 # p 110
N83-18067 # p 17
N83-18068 # p 17
N83-18069 # p 62
N83-18070 # p 110
N83-18071 # p 167
N83-18072 # p 62
N83-18073 # p 110
N83-18074 # p 194
N83-18075 # p 111
N83-18076 # p 17
N83-18077 # p 18
N83-18078 # p 111
N83-18079 # p 167
N83-18080 # p 18
N83-18081 # p 18
N83-18082 # p 111
N83-18083 # p 111
N83-18084 # p 167
N83-18085 # p 111
N83-18100 # p 18

N83-18101 # p 111
N83-18102 # p 186
N83-18104 # p 18
N83-18108 # p 18
N83-18109 # p 19
N83-18116 # p 19
N83-18117 # p 19
N83-18118 # p 19
N83-18123 # p 111
N83-18133 # p 19
N83-18137 # p 112
N83-18138 # p 112
N83-18139 # p 112
N83-18140 # p 112
N83-18141 # p 112
N83-18143 # p 112
N83-18172 # p 168
N83-18325 # p 112
N83-18326 # p 112
N83-18327 # p 112
N83-18328 # p 113
N83-18329 # p 113
N83-18416 # p 113
N83-18451 # p 168
N83-18464 # p 113
N83-18467 # p 19
N83-18491 # p 62
N83-18511 # p 168
N83-18512 # p 168
N83-18554 # p 113
N83-18555 # p 19
N83-18591 # p 194
N83-18592 # p 20
N83-18647* # p 20
N83-18875 # p 113
N83-18880 # p 113
N83-18883 # p 113
N83-18904 # p 194
N83-18921 # p 62
N83-18924* # p 114
N83-18940 # p 168
N83-18944 # p 114
N83-18963 # p 20
N83-18964 # p 114
N83-18967 # p 62
N83-18968 # p 62
N83-18978 # p 20
N83-19078 # p 114
N83-19099 # p 168
N83-19101 # p 114
N83-19102 # p 168
N83-19104 # p 89
N83-19136 # p 63
N83-19155* # p 114
N83-19183* # p 114
N83-19196 # p 115
N83-19197 # p 115
N83-19198 # p 115
N83-19213 # p 20
N83-19215* # p 63
N83-19216* # p 115
N83-19217* # p 115
N83-19219* # p 63
N83-19220* # p 63
N83-19221* # p 63
N83-19222* # p 63
N83-19223* # p 63
N83-19224* # p 64
N83-19225* # p 64
N83-19226* # p 169
N83-19227* # p 20
N83-19228* # p 169
N83-19229 # p 169
N83-19230 # p 115
N83-19231* # p 169
N83-19232* # p 169
N83-19233* # p 169
N83-19234* # p 169
N83-19235* # p 170
N83-19236* # p 170
N83-19237* # p 115
N83-19238* # p 116
N83-19239* # p 116
N83-19240* # p 116
N83-19241* # p 170
N83-19242* # p 170
N83-19243* # p 170
N83-19244* # p 170
N83-19246* # p 170
N83-19247* # p 171
N83-19248* # p 171
N83-19249* # p 171
N83-19250* # p 116
N83-19251* # p 116
N83-19252* # p 171
N83-19253* # p 171

N83-19254* # p 171
N83-19255* # p 171
N83-19256* # p 171
N83-19257* # p 172
N83-19258* # p 172
N83-19259* # p 172
N83-19260* # p 172
N83-19261* # p 172
N83-19262* # p 172
N83-19263* # p 172
N83-19264* # p 172
N83-19265* # p 172
N83-19266* # p 173
N83-19267* # p 173
N83-19268* # p 173
N83-19269* # p 173
N83-19270* # p 116
N83-19271* # p 173
N83-19272* # p 173
N83-19273* # p 174
N83-19275 # p 174
N83-19276 # p 64
N83-19277 # p 194
N83-19278 # p 174
N83-19279 # p 64
N83-19280 # p 64
N83-19281 # p 64
N83-19282 # p 174
N83-19283 # p 65
N83-19285 # p 65
N83-19286 # p 65
N83-19287 # p 65
N83-19289 # p 20
N83-19290 # p 21
N83-19291 # p 21
N83-19292 # p 21
N83-19293 # p 65
N83-19294 # p 21
N83-19295 # p 65
N83-19296 # p 65
N83-19297 # p 66
N83-19299 # p 116
N83-19302 # p 117
N83-19303 # p 66
N83-19304 # p 21
N83-19305 # p 21
N83-19306 # p 22
N83-19307 # p 22
N83-19308 # p 194
N83-19309 # p 174
N83-19310 # p 117
N83-19312 # p 66
N83-19313 # p 22
N83-19314 # p 22
N83-19315 # p 200
N83-19316 # p 200
N83-19317 # p 200
N83-19318 # p 200
N83-19328 # p 22
N83-19329 # p 22
N83-19330 # p 66
N83-19331 # p 23
N83-19333 # p 23
N83-19334 # p 23
N83-19340 # p 23
N83-19356 # p 23
N83-19378 # p 117
N83-19398 # p 174
N83-19420 # p 23
N83-19462 # p 23
N83-19567 # p 66
N83-19595 # p 174
N83-19596* # p 186
N83-19615 # p 174
N83-19627 # p 66
N83-19634 # p 24
N83-19651* # p 24
N83-19702 # p 200
N83-19780* # p 24
N83-19781* # p 66
N83-19812* # p 117
N83-19826* # p 89
N83-19827 # p 117
N83-19829 # p 117
N83-19853 # p 118
N83-19854 # p 118
N83-19858 # p 118
N83-19860 # p 118
N83-19862 # p 118
N83-19865 # p 119
N83-19866 # p 119
N83-19868 # p 119
N83-19869 # p 119
N83-19870 # p 119
N83-19872 # p 119
N83-19873 # p 119

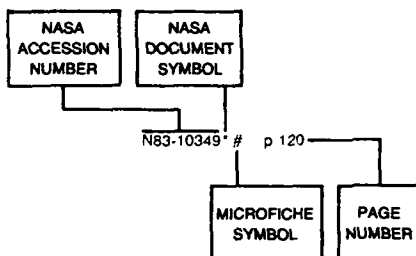
ACCESSION NUMBER INDEX

ACCESSION NUMBER INDEX

ENERGY / A Continuing Bibliography (Issue 38)

JULY 1983

Typical Accession Number Index Listing



Listings in this index are arranged alphanumerically by accession number. The page number listed to the right indicates the page on which the citation is located. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A83-19661	#	p 1	A83-22908	#	p 40	A83-25375	#	p 83	A83-27250*	#	p 49	A83-28941	#	p 191
A83-19837	#	p 85	A83-22909	#	p 40	A83-25619	#	p 49	A83-27254*	#	p 49	A83-28942	#	p 53
A83-19847	#	p 90	A83-22910	#	p 40	A83-25687	#	p 153	A83-27255*	#	p 49	A83-28956	#	p 161
A83-19876	#	p 149	A83-22911	#	p 40	A83-25689*	#	p 44	A83-27256	#	p 50	A83-28969	#	p 191
A83-19883	#	p 149	A83-22912	#	p 41	A83-25691	#	p 93	A83-27257	#	p 50	A83-29013	#	p 161
A83-19884	#	p 149	A83-22913	#	p 41	A83-25760	#	p 185	A83-27258	#	p 50	A83-29039	#	p 53
A83-19885	#	p 37	A83-22914	#	p 41	A83-26052	#	p 153	A83-27259	#	p 50	A83-29089	#	p 161
A83-19891	#	p 149	A83-22915	#	p 41	A83-26061	#	p 45	A83-27260*	#	p 50	A83-29393	#	p 4
A83-19893	#	p 37	A83-22916	#	p 41	A83-26064	#	p 45	A83-27265	#	p 156	A83-29407	#	p 54
A83-19991	#	p 37	A83-22917	#	p 41	A83-26065	#	p 45	A83-27266	#	p 156	A83-29457	#	p 185
A83-20082	#	p 85	A83-22924*	#	p 41	A83-26198	#	p 93	A83-27267	#	p 156	A83-29512	#	p 54
A83-20136	#	p 37	A83-23126	#	p 151	A83-26199	#	p 93	A83-27273	#	p 156	A83-29513	#	p 54
A83-20137	#	p 37	A83-23127	#	p 41	A83-26199	#	p 93	A83-27274	#	p 50	A83-29514	#	p 54
A83-20137	#	p 37	A83-23128	#	p 151	A83-26200	#	p 93	A83-27275	#	p 156	A83-29704	#	p 54
A83-20139	#	p 37	A83-23129	#	p 41	A83-26241	#	p 3	A83-27276	#	p 156	A83-29896	#	p 54
A83-20224	#	p 1	A83-23130	#	p 151	A83-26641	#	p 3	A83-27277	#	p 157	A83-29897*	#	p 162
A83-20265*	#	p 90	A83-23131	#	p 151	A83-26805	#	p 94	A83-27278	#	p 157	A83-29946	#	p 55
A83-20435	#	p 38	A83-23132	#	p 188	A83-26882	#	p 45	A83-27280	#	p 157			
A83-20436	#	p 90	A83-23133	#	p 151	A83-26920	#	p 94	A83-27281	#	p 157			
A83-20576*	#	p 149	A83-23134	#	p 151	A83-26921	#	p 94	A83-27282	#	p 157			
A83-20580	#	p 38	A83-23135	#	p 151	A83-27126	#	p 153	A83-27284	#	p 157	N83-16329*	#	p 4
A83-20581	#	p 38	A83-23137*	#	p 41	A83-27127*	#	p 185	A83-27285	#	p 157	N83-16341*	#	p 4
A83-20581	#	p 38	A83-23139	#	p 151	A83-27128	#	p 185	A83-27286	#	p 158	N83-16343*	#	p 162
A83-20586	#	p 85	A83-23164	#	p 41	A83-27129	#	p 185	A83-27288*	#	p 158	N83-16353	#	p 94
A83-20590	#	p 150	A83-23171	#	p 151	A83-27131*	#	p 45	A83-27290	#	p 158	N83-16411	#	p 94
A83-20594	#	p 38	A83-23191	#	p 91	A83-27132*	#	p 45	A83-27294	#	p 158	N83-16417*	#	p 94
A83-20596	#	p 150	A83-23212	#	p 42	A83-27135	#	p 45	A83-27295	#	p 158	N83-16419*	#	p 191
A83-20751	#	p 38	A83-23219	#	p 42	A83-27138*	#	p 46	A83-27296	#	p 158	N83-16427	#	p 95
A83-20802	#	p 150	A83-23239	#	p 1	A83-27139*	#	p 46	A83-27297	#	p 159	N83-16429	#	p 95
A83-20959	#	p 39	A83-23333	#	p 42	A83-27140*	#	p 46	A83-27298*	#	p 159	N83-16439	#	p 95
A83-21014	#	p 90	A83-23437	#	p 1	A83-27147*	#	p 46	A83-27299	#	p 159	N83-16444	#	p 95
A83-21066	#	p 39	A83-23464	#	p 184	A83-27148	#	p 46	A83-27300	#	p 159	N83-16445	#	p 95
A83-21423	#	p 91	A83-23665	#	p 42	A83-27150	#	p 153	A83-27301	#	p 51	N83-16446	#	p 95
A83-21458	#	p 91	A83-23701	#	p 86	A83-27151	#	p 188	A83-27302	#	p 189	N83-16459	#	p 96
A83-21562	#	p 188	A83-23748	#	p 92	A83-27152*	#	p 185	A83-27303	#	p 189	N83-16460	#	p 96
A83-21627	#	p 39	A83-23859	#	p 42	A83-27153	#	p 46	A83-27304	#	p 189	N83-16461	#	p 96
A83-21945	#	p 91	A83-23877	#	p 92	A83-27157	#	p 153	A83-27305	#	p 190	N83-16470	#	p 162
A83-21946	#	p 91	A83-23880	#	p 42	A83-27159	#	p 3	A83-27306	#	p 190	N83-16493*	#	p 88
A83-22020	#	p 150	A83-23881	#	p 42	A83-27160	#	p 3	A83-27307	#	p 190	N83-16515	#	p 162
A83-22021	#	p 150	A83-23882	#	p 42	A83-27161	#	p 154	A83-27308	#	p 190	N83-16525*	#	p 96
A83-22022	#	p 150	A83-23883	#	p 43	A83-27162	#	p 154	A83-27309	#	p 190	N83-16543	#	p 96
A83-22083	#	p 86	A83-23884	#	p 43	A83-27164	#	p 188	A83-27310	#	p 190	N83-16549	#	p 96
A83-22275	#	p 39	A83-23924	#	p 184	A83-27169	#	p 188	A83-27311	#	p 191	N83-16550	#	p 96
A83-22318	#	p 150	A83-24035	#	p 92	A83-27169	#	p 188	A83-27313	#	p 191	N83-16553	#	p 97
A83-22324	#	p 91	A83-24041	#	p 1	A83-27175	#	p 189	A83-27314	#	p 191	N83-16556	#	p 162
A83-22337	#	p 39	A83-24194	#	p 151	A83-27176	#	p 189	A83-27315	#	p 51	N83-16557	#	p 162
A83-22344	#	p 1	A83-24195	#	p 152	A83-27177*	#	p 189	A83-27316	#	p 51	N83-16558	#	p 97
A83-22421	#	p 91	A83-24196	#	p 152	A83-27179*	#	p 47	A83-27317	#	p 51	N83-16559	#	p 97
A83-22617	#	p 39	A83-24202	#	p 152	A83-27180	#	p 154	A83-27323	#	p 159	N83-16560	#	p 97
A83-22618	#	p 39	A83-24202	#	p 152	A83-27185	#	p 154	A83-27324	#	p 159	N83-16561	#	p 97
A83-22619	#	p 39	A83-24251	#	p 2	A83-27186	#	p 154	A83-27325	#	p 160	N83-16562	#	p 97
A83-22620	#	p 40	A83-24252	#	p 2	A83-27201*	#	p 154	A83-27326*	#	p 160	N83-16563	#	p 98
A83-22675	#	p 151	A83-24255	#	p 2	A83-27207	#	p 3	A83-27327	#	p 160	N83-16564	#	p 98
A83-22701	#	p 188	A83-24256	#	p 2	A83-27208	#	p 154	A83-27327	#	p 160	N83-16565	#	p 98
A83-22903	#	p 40	A83-24279	#	p 2	A83-27209	#	p 86	A83-27328	#	p 160	N83-16569	#	p 5
A83-22905	#	p 40	A83-24353*	#	p 43	A83-27210	#	p 87	A83-27329	#	p 160	N83-16572	#	p 98
A83-22907	#	p 40	A83-24357*	#	p 86	A83-27211	#	p 3	A83-27333	#	p 87	N83-16630*	#	p 188
			A83-24358*	#	p 184	A83-27212	#	p 3	A83-27334	#	p 87			
			A83-24361*	#	p 2	A83-27212	#	p 155	A83-27336	#	p 87			

REPORT NUMBER INDEX

W83-00256

SAND-81-7085/12	p 57	N83-16896 #	SOLAR-1096-82/14	p 57	N83-16895 #	UCRL-87219	p 175	N83-20114 #
SAND-81-7085/5	p 65	N83-19286 #	SOLAR-2116-82/14	p 57	N83-16894 #	UCRL-87677	p 176	N83-20770 #
SAND-81-7087/4	p 78	N83-21606 #						
SAND-81-7088-6	p 69	N83-20391 #	SOLAR/0010-81/12	p 64	N83-19280 #	UMTA-MN-11-0004-82-1	p 21	N83-19305 #
SAND-81-7088/5	p 81	N83-22774 #	SOLAR/0010-82/09	p 80	N83-21722 #	UMTA-MN-11-0004-82-2	p 21	N83-19304 #
SAND-81-7089/4	p 78	N83-21605 #	SOLAR/0024-82/41	p 56	N83-16889 #			
SAND-81-7089/5	p 73	N83-21517 #	SOLAR/1026-82/50	p 65	N83-19283 #	UMTA-VA-06-0087-82-1	p 11	N83-17428 #
SAND-81-7091/3	p 65	N83-19293 #	SOLAR/1027-82/50	p 58	N83-16911 #			
SAND-81-7099/7-VOL-7	p 76	N83-21566 #	SOLAR/1096-82/50	p 77	N83-21570 #	US-PATENT-APPL-SN-243682	p 186	N83-19596* #
SAND-81-7100/7-VOL-7	p 76	N83-21564 #	SOLAR/1106-82/14	p 57	N83-16890 #	US-PATENT-APPL-SN-408266	p 89	N83-19826* #
SAND-81-7102/5-VOL-5	p 76	N83-21563 #	SOLAR/1107-82/14	p 57	N83-16890 #	US-PATENT-APPL-SN-433196	p 60	N83-18025* #
SAND-81-7112	p 69	N83-20390 #	SOLAR/1110-82/14	p 57	N83-16890 #	US-PATENT-APPL-SN-457990	p 187	N83-20155* #
SAND-81-7175-VOL-2	p 76	N83-21562 #				US-PATENT-APPL-SN-465364	p 68	N83-20374* #
SAND-81-7175/1-VOL-1	p 70	N83-20398 #	SRAMSOE-256-VOL-3	p 148	N83-22949 #			
SAND-81-7177	p 69	N83-20389 #				US-PATENT-CLASS-165-104 26	p 186	N83-19596* #
SAND-81-7178	p 65	N83-19287 #	SRC-CR-81-74-VOL-1	p 163	N83-16867 #	US-PATENT-CLASS-165-134R	p 186	N83-19596* #
SAND-81-7179/3-APP-VOL-3	p 70	N83-20397 #				US-PATENT-CLASS-29-157 3H	p 186	N83-19596* #
SAND-81-7180	p 78	N83-21615 #	SRC-TR-82-862	p 33	N83-21616 #			
SAND-81-7189	p 69	N83-20396 #				US-PATENT-4,372,377	p 186	N83-19596* #
SAND-81-7192	p 82	N83-22796 #	SSD82-0172	p 67	N83-20360* #			
SAND-81-8186	p 79	N83-21625 #				UT/CES-PS-19	p 34	N83-21666 #
SAND-81-8263	p 77	N83-21582 #	SSEC/SP-32288	p 17	N83-18058 #			
SAND-82-0092/1	p 82	N83-22776 #				UTRC-R82-955621	p 55	N83-16710 #
SAND-82-0099	p 72	N83-21413 #	SSEC/TP-31298	p 66	N83-19303 #	UTRC-R82-955750-4	p 175	N83-20054 #
SAND-82-0172	p 135	N83-21661 #	SSEC/TP-412832	p 18	N83-18077 #			
SAND-82-0214C	p 120	N83-19876 #				UWRL/P-81/05	p 192	N83-16868 #
SAND-82-0240C	p 36	N83-22802 #	STDR-82-15	p 169	N83-19228* #			
SAND-82-0291	p 72	N83-21154 #				VKI-LS-1982-03	p 200	N83-19316 #
SAND-82-0345	p 180	N83-21608 #	SWRI-6800-120/1	p 175	N83-20161 #			
SAND-82-0394C	p 100	N83-16906 #				VPI/CER-3900303	p 34	N83-21650 #
SAND-82-0494	p 101	N83-16910 #	TAE-428	p 106	N83-17729 #			
SAND-82-0522C	p 113	N83-18464 #				VR-82-05-11	p 135	N83-21632 #
SAND-82-0631	p 178	N83-21526 #	TENRAC/EDF-063	p 78	N83-21614 #			
SAND-82-0732	p 78	N83-21613 #	TENRAC/EDF-065	p 141	N83-22464 #	WDGER-OP-82-6	p 145	N83-22789 #
SAND-82-0957C	p 68	N83-20388 #	TENRAC/EDF-066	p 146	N83-22807 #			
SAND-82-1138	p 187	N83-22786 #	TENRAC/EDF-081	p 82	N83-22795 #	WSU-82/15-7	p 145	N83-22789 #
SAND-82-1154C	p 68	N83-20387 #	TENRAC/EDF-082	p 83	N83-22818 #			
SAND-82-1193C	p 120	N83-19877 #				WSUN-113	p 101	N83-16928 #
SAND-82-1744	p 75	N83-21556 #	TE4224-239-82	p 8	N83-16947 #			
SAND-82-7049	p 198	N83-22834 #	TE4274-160-82	p 66	N83-19312 #	W83-00256	p 140	N83-22380 #
SAND-82-7059	p 74	N83-21522 #	TE660-406-82	p 21	N83-19294 #			
SAND-82-7102	p 75	N83-21547 #						
SAND-82-7116	p 77	N83-21585 #	TME-3170	p 63	N83-19221* #			
SAND-82-7117	p 77	N83-21584 #						
SAND-82-7120	p 79	N83-21634 #	TPR-11	p 74	N83-21539 #			
SAND-82-7124	p 82	N83-22797 #	TPR-2	p 121	N83-19940 #			
SAND-82-7128	p 80	N83-21637 #						
SAND-82-8206	p 81	N83-22599 #	TPS-80-756	p 29	N83-20744 #			
SAND-82-8207	p 36	N83-22801 #						
SAND-82-8210	p 66	N83-19898 #	TR-343	p 8	N83-16953 #			
			TR-4	p 137	N83-22342 #			
SAPR-4	p 166	N83-17424* #	TR-80/025-001	p 34	N83-21651 #			
			TR-9	p 32	N83-21610 #			
SDL-82-2177-29Q	p 140	N83-22367 #						
SER/PR-8143-1-T10	p 74	N83-21539 #	TRT-3	p 31	N83-21552 #			
			TRT-3	p 32	N83-21553 #			
SERI/CP-635-1273	p 169	N83-19231* #	TRW-3724	p 81	N83-22756* #			
			TRW-38512 000	p 81	N83-22742* #			
SERI/PR-232-1511	p 124	N83-20418 #						
SERI/PR-233-1395	p 71	N83-20417 #	TS-123	p 11	N83-17428 #			
SERI/PR-622-1349	p 113	N83-18875 #						
SERI/SP-721-1135R	p 76	N83-21569 #	TVA/OACD-82/16	p 101	N83-16975 #			
SERI/STR-211-1707	p 31	N83-21543 #	TVA/OP-ECR-82-30	p 75	N83-21546 #			
SERI/TP-211-1609	p 83	N83-22814 #	UCID-19227-81	p 18	N83-18081 #			
SERI/TP-211-1637	p 84	N83-22831 #	UCID-19275	p 99	N83-16837 #			
SERI/TP-212-1493	p 61	N83-18059 #	UCID-19308	p 19	N83-18133 #			
SERI/TP-214-1464	p 164	N83-16883 #	UCID-19348	p 107	N83-17741 #			
SERI/TP-235-1774	p 129	N83-21176 #	UCID-19363	p 142	N83-22466 #			
SERI/TP-254-1421R	p 32	N83-21597 #	UCID-19412-VOL-1	p 183	N83-22820 #			
SERI/TP-254-1482	p 61	N83-18046 #	UCID-19412-VOL-2	p 182	N83-22771 #			
SERI/TP-255-1497	p 60	N83-17723 #	UCID-19412-VOL-3	p 182	N83-22772 #			
SERI/TP-614-1219	p 60	N83-17723 #	UCID-19412-VOL-4	p 183	N83-22810 #			
	p 56	N83-16881 #	UCID-19412-VOL-5	p 182	N83-22773 #			
			UCID-19576	p 184	N83-23243 #			
SERI/TR-11052-2	p 178	N83-21548 #	UCID-19591	p 180	N83-22030 #			
SERI/TR-11095-1	p 13	N83-17824 #						
SERI/TR-211-1539	p 180	N83-21601 #	UCLA-12-1385	p 85	N83-22856 #			
SERI/TR-214-1362	p 71	N83-20409 #						
SERI/TR-252-1420R-REV	p 167	N83-18071 #	UCRL-15448	p 196	N83-21574 #			
SERI/TR-252-1422	p 175	N83-20403 #	UCRL-15473	p 196	N83-21629 #			
SERI/TR-253-1356	p 79	N83-21620 #	UCRL-15502-REV-1	p 198	N83-23244 #			
SERI/TR-631-1122R	p 57	N83-16900 #	UCRL-15503	p 180	N83-21623 #			
SERI/TR-631-1147	p 174	N83-19282 #	UCRL-15504	p 195	N83-20430 #			
SERI/TR-632-1311	p 76	N83-21568 #	UCRL-15510	p 146	N83-22821 #			
SERI/TR-632-1354	p 70	N83-20404 #	UCRL-52000-82-1	p 164	N83-16922 #			
SERI/TR-642-1149	p 60	N83-17001 #	UCRL-53215	p 23	N83-19333 #			
SERI/TR-732-604R-VOL-2	p 134	N83-21596 #	UCRL-53236	p 88	N83-16563 #			
SERI/TR-8041-13-T1	p 83	N83-22799 #	UCRL-86502	p 19	N83-18118 #			
SERI/TR-8041-14-T1	p 58	N83-16917 #	UCRL-86707	p 29	N83-20842 #			
SERI/TR-98085-2	p 179	N83-21599 #	UCRL-86983	p 8	N83-16956 #			
SERI/TR-98281-03	p 124	N83-20395 #	UCRL-87012	p 103	N83-17651 #			
SERI/TR-98282-2	p 182	N83-22783 #	UCRL-87037	p 165	N83-17330 #			
			UCRL-87116	p 174	N83-19615 #			

NVO-240

REPORT NUMBER INDEX

NVO-240	p 179	N83-21591 #	PB82-255431	p 193	N83-16950 #	PNL-4422-VOL-2	p 99	N83-16866 #
NWC-TP-6358	p 117	N83-19378 #	PB82-257536	p 165	N83-16937 #	PNL-4431	p 174	N83-19398 #
NYSERDA-82-17	p 7	N83-16942 #	PB82-258047	p 165	N83-16941 #	PNL-4433	p 180	N83-21633 #
NYSERDA-82-2	p 7	N83-16943 #	PB82-258757	p 193	N83-16934 #	PNL-4486	p 196	N83-21528 #
NZERDC-66	p 26	N83-20412 #	PB82-258971	p 165	N83-16935 #			
NZERDC-68	p 26	N83-20411 #	PB82-259839	p 59	N83-16936 #	PPPL-1856	p 165	N83-17325 #
OAQ/TR-81/0056	p 102	N83-17414* #	PB82-259896	p 193	N83-16933 #			
ORAU/IEA-82-3(M)	p 133	N83-21581 #	PB82-260019	p 11	N83-17428 #	PR-2	p 25	N83-20334 #
ORNL-5825	p 36	N83-22828 #	PB82-260100	p 59	N83-16940 #			
ORNL/CON-70	p 79	N83-21626 #	PB82-260456	p 165	N83-16938 #	PSI-TR-289	p 163	N83-16864 #
ORNL/CON-78	p 6	N83-16886 #	PB82-260944	p 96	N83-16460 #			
ORNL/CON-87	p 32	N83-21572 #	PB82-262114	p 59	N83-16939 #	QPR-2	p 81	N83 22745* #
ORNL/CON-88	p 6	N83-16924 #	PB82-262569	p 8	N83-16947 #	QPR-4	p 111	N83-18085 #
ORNL/CON-89	p 33	N83-21630 #	PB82-262577	p 96	N83-16461 #	QPR-5	p 118	N83-19858 #
ORNL/FMP-81/4	p 111	N83-18085 #	PB82-263526	p 7	N83-16942 #			
ORNL/MIT-355	p 126	N83-21076 #	PB82-265364	p 5	N83-16766 #	QR-1	p 96	N83-16549 #
ORNL/SUB-79/13837/7	p 19	N83-18467 #	PB82-903601	p 199	N83-16891 #	QR-1	p 163	N83-16864 #
ORNL/SUB-80/28906/1	p 179	N83-21571 #	PB83-100065	p 71	N83-20436 #	QR-2	p 108	N83-18007 #
ORNL/SUB-81/92352/1	p 132	N83-21529 #	PB83-100461	p 67	N83-19962 #	QR-2	p 138	N83-22357 #
ORNL/TM-7680-S1	p 122	N83-19945 #	PB83-100792	p 122	N83-20073 #	QR-3	p 63	N83-19221* #
ORNL/TM-7887-6	p 22	N83-19329 #	PB83-101139	p 30	N83-20844 #	QR-3	p 138	N83-22354 #
ORNL/TM-7933	p 139	N83-22360 #	PB83-101147	p 30	N83-20845 #			
ORNL/TM-7964	p 131	N83-21519 #	PB83-101329	p 29	N83-20459 #	QTPR-2	p 113	N83-18416 #
ORNL/TM-8015	p 97	N83-16558 #	PB83-102236	p 30	N83-21187 #	QTPR-3	p 167	N83-18084 #
ORNL/TM-8116	p 111	N83-18082 #	PB83-102301	p 72	N83-20441 #	QTPR-5	p 103	N83-17641 #
ORNL/TM-8136	p 127	N83-21083 #	PB83-102319	p 67	N83-19963 #	QTPR-6	p 29	N83-20457 #
ORNL/TM-8153	p 111	N83-18083 #	PB83-102327	p 28	N83-20442 #			
ORNL/TM-8163	p 98	N83-16572 #	PB83-102335	p 176	N83-20437 #	QTR-2	p 68	N83-20382 #
ORNL/TM-8178	p 167	N83-18079 #	PB83-10467	p 125	N83-20440 #	QTR-6329-6	p 63	N83-19220* #
ORNL/TM-8194	p 105	N83-17708 #	PB83-104745	p 84	N83-22841 #			
ORNL/TM-8298	p 80	N83-22407 #	PB83-105593	p 28	N83-20438 #	RAD-81-203-001-12-23-VOL-1	p 29	N83-20459 #
ORNL/TM-8390	p 33	N83-21611 #	PB83-106443	p 29	N83-20511 #	RAD-81-203-001-12-23-VOL-2	p 29	N83-20469 #
ORNL/TM-8396	p 73	N83-21518 #	PB83-107813	p 128	N83-21091 #	RAD-82-203-001-30-17	p 23	N83-19356 #
ORNL/TM-8440	p 9	N83-16972 #	PB83-108605	p 140	N83-22380 #			
ORNL/TM-8489	p 192	N83-16875 #	PB83-109587	p 123	N83-20342 #	RAND-P-6796	p 20	N83-18978 #
ORNL/TM-8501	p 177	N83-21075 #	PB83-109884	p 120	N83-19881 #			
ORNL/TM-8520	p 128	N83-21089 #	PB83-109918	p 122	N83-19946 #	RAND/R-2899-CEC	p 25	N83-20363 #
OTA-BP-E-13	p 37	N83-23250 #	PB83-112433	p 29	N83-20525 #			
OWRT-C-00146-D(1403)(1)	p 140	N83-22380 #	PB83-114603	p 36	N83-22838 #	RDA-TR-120900-001	p 163	N83-16861 #
P-500-82-005	p 6	N83-16921 #	PB83-115139	p 130	N83-21188 #			
P-500-82-009	p 147	N83-22826 #	PB83-116830	p 149	N83-23249 #	RENAC/EDF-064	p 83	N83-22809 #
PB-255589	p 112	N83-18138 #	PB83-117366	p 29	N83-20469 #			
PB82-225491	p 24	N83-19634 #	PB83-119545	p 184	N83-22839 #	REPT-019-028	p 98	N83-16564 #
PB82-231663	p 66	N83-19312 #	PB83-119610	p 84	N83-22842 #	REPT-109/ET-FUC/79	p 7	N83-16943 #
PB82-232919	p 194	N83-18904 #	PB83-121533	p 200	N83-22480 #	REPT-24	p 140	N83-22440 #
PB82-233172	p 23	N83-19420 #	PB83-121723	p 28	N83-20439 #	REPT-5	p 195	N83-20376 #
PB82-234139	p 117	N83-19310 #	PB83-122580	p 34	N83-22486 #	REPT-711	p 60	N83-18023* #
PB82-235979	p 200	N83-19315 #	PB83-122663	p 85	N83-22843 #	REPT-78-04-09-8	p 122	N83-20073 #
PB82-238544	p 22	N83-19313 #	PB83-124560	p 84	N83-22840 #	REPT-81-9	p 100	N83-16907 #
PB82-239260	p 23	N83-19356 #	PB83-124743	p 36	N83-22867 #	REPT-85279	p 96	N83-16461 #
PB82-239716	p 20	N83-19213 #	PB83-126078	p 142	N83-22470 #			
PB82-240037	p 22	N83-19314 #	PB83-126086	p 37	N83-23250 #	RFP-3046/2	p 180	N83-21602 #
PB82-240201	p 23	N83-19340 #	PB83-126292	p 147	N83-22845 #			
PB82-240219	p 113	N83-18883 #	PB83-128116	p 147	N83-22844 #	RTD-242	p 174	N83-19278 #
PB82-240763	p 21	N83-19304 #	PB83-131805	p 148	N83-22949 #			
PB82-240771	p 21	N83-19305 #	PB83-136275	p 147	N83-22903 #	R80-AEG-417	p 4	N83-16341* #
PB82-242454	p 62	N83-18921 #	PB83-136283	p 147	N83-22904 #	R81-535720-1Q	p 96	N83-16549 #
PB82-243825	p 62	N83-18967 #	PB83-136291	p 147	N83-22896 #	R82-955319-20	p 105	N83-17728* #
PB82-243833	p 62	N83-18968 #				SAE PAPER 820860	p 185	A83-25760 #
PB82-243858	p 114	N83-18964 #	PNL-SA-10046	p 106	N83-17739 #	SAI-444-82-140-LJ	p 32	N83-21553 #
PB82-244013	p 23	N83-19462 #	PNL-SA-10063	p 61	N83-18053 #	SAI-444-82-141-LJ	p 31	N83-21552 #
PB82-244245	p 114	N83-19078 #	PNL-SA-10072	p 16	N83-18054 #	SAI-444-82-142-LJ	p 32	N83-21559 #
PB82-244724	p 89	N83-19104 #	PNL-SA-10076	p 197	N83-22804 #	SAI-444-82-143-LJ	p 33	N83-21612 #
PB82-245820	p 22	N83-19306 #	PNL-SA-10166	p 17	N83-18067 #	SAI-444-82-170-LJ	p 184	N83-22839 #
PB82-246752	p 22	N83-19307 #	PNL-SA-10229	p 198	N83-22806 #	SAI-83-045-CHA	p 140	N83-22439* #
PB82-249921	p 194	N83-19308 #	PNL-SA-10591	p 106	N83-17734 #			
PB82-249954	p 174	N83-19309 #	PNL-SA-8991	p 110	N83-18057 #	SAN-0499-27-REV	p 65	N83-19295 #
PB82-250697	p 98	N83-16564 #	PNL-SA-9063	p 110	N83-18058 #	SAN-049983-REV	p 75	N83-21551 #
PB82-254087	p 113	N83-18880 #	PNL-SA-9173	p 98	N83-16835 #			
PB82-254590	p 164	N83-16932 #	PNL-SA-9394	p 101	N83-17023 #	SAND-80-0872	p 77	N83-21603 #
PB82-254616	p 98	N83-16565 #	PNL-SA-9741	p 102	N83-17024 #	SAND-80-7017-VOL-2	p 24	N83-19956 #
PB82-254640	p 165	N83-16944 #	PNL-SA-9742	p 62	N83-18491 #	SAND-80-7075	p 84	N83-22822 #
PB82-254863	p 55	N83-16710 #	PNL-SA-9858A	p 194	N83-18045 #	SAND-80-7172	p 69	N83-20394 #
PB82-255084	p 10	N83-16985 #	PNL-SA-9891	p 162	N83-16557 #	SAND-81-0293C	p 56	N83-16878 #
PB82-255159	p 8	N83-16945 #	PNL-SA-9954	p 110	N83-18047 #	SAND-81-1284C	p 60	N83-18043 #
PB82-255167	p 96	N83-16459 #	PNL-SA-9983	p 100	N83-16905 #	SAND-81-1618	p 56	N83-16882 #
PB82-255191	p 60	N83-16948 #				SAND-81-1735	p 76	N83-21567 #
PB82-255209	p 59	N83-16946 #	PNL-3374	p 197	N83-21640 #	SAND-81-1776C	p 62	N83-18062 #
PB82-255258	p 193	N83-16949 #	PNL-3568	p 127	N83-21084 #	SAND-81-1820	p 107	N83-17852 #
PB82-255290	p 7	N83-16943 #	PNL-3745	p 102	N83-17027 #	SAND-81-1862	p 82	N83-22777 #
			PNL-3830-VOL-6	p 108	N83-18009 #	SAND-81-2051/2	p 19	N83-18117 #
			PNL-3830-VOL-8	p 109	N83-18015 #	SAND-81-2081C	p 69	N83-20393 #
			PNL-3903-PT-3	p 134	N83-21598 #	SAND-81-2203	p 111	N83-18078 #
			PNL-4004	p 108	N83-18005 #	SAND-81-2270	p 74	N83-21537 #
			PNL-4068	p 135	N83-21631 #	SAND-81-2542	p 117	N83-19302 #
			PNL-4114	p 100	N83-16887 #	SAND-81-2563	p 63	N83-19136 #
			PNL-4210	p 180	N83-21622 #	SAND-81-2625C	p 5	N83-16777 #
			PNL-4349	p 165	N83-17026 #	SAND-81-7013	p 69	N83-20392 #
			PNL-4355	p 10	N83-16973 #	SAND-81-7029	p 62	N83-18072 #
			PNL-4357	p 136	N83-21694 #	SAND-81-7040	p 72	N83-20768 #
			PNL-4359	p 20	N83-19289 #	SAND-81-7080-2	p 74	N83-21541 #
			PNL-4361	p 136	N83-21723 #	SAND-81-7080/1-VOL-1	p 57	N83-16897 #
			PNL-4407	p 102	N83-17028 #	SAND-81-7080/3-VOL-3	p 84	N83-22830 #
			PNL-4422-VOL-1	p 99	N83-16865 #	SAND-81-7083/1	p 84	N83-22819 #

REPORT NUMBER INDEX

NSRP-NE-508

LA-UR-82-674	p 35	N83-22800 #	NAS 1 15 83036	p 182	N83-22749* #	NASA-CR-168109	p 178	N83-21509* #
LA-UR-82-989	p 31	N83-21201 #	NAS 1 15 83046	p 183	N83-16857* #	NASA-CR-168110	p 181	N83-22747* #
			NAS 1 15 83072	p 120	N83-19920* #	NASA-CR-169750	p 96	N83-16543* #
LA-8995-MS	p 22	N83-19328 #	NAS 1 15 84631	p 187	N83-22541* #	NASA-CR-169751	p 94	N83-16417* #
LA-9075-MS	p 101	N83-17000 #	NAS 1 15 84951	p 60	N83-18023* #	NASA-CR-169755	p 4	N83-16329* #
LA-9078-MS	p 148	N83-23138 #	NAS 1 26 165127	p 163	N83-16859* #	NASA-CR-169790	p 191	N83-16419* #
LA-9102-MS	p 107	N83-17742 #	NAS 1 26 165148	p 4	N83-16341* #	NASA-CR-169792	p 101	N83-16993* #
LA-9106-C	p 18	N83-18100 #	NAS 1 26 165326-VOL-1	p 143	N83-22750* #	NASA-CR-169797	p 88	N83-16493* #
LA-9149-TASE	p 59	N83-16927 #	NAS 1 26 165326-VOL-2	p 143	N83-22751* #	NASA-CR-169801	p 191	N83-16858* #
LA-9218-MS	p 17	N83-18076 #	NAS 1 26 165326-VOL-3	p 144	N83-22754* #	NASA-CR-169802	p 102	N83-17414* #
LA-9226	p 148	N83-23147 #	NAS 1 26 165472	p 182	N83-22748* #	NASA-CR-169890	p 60	N83-17871* #
LA-9227	p 184	N83-23146 #	NAS 1 26 165566	p 181	N83-22746* #	NASA-CR-169899	p 63	N83-19221* #
LA-9269-PR	p 139	N83-22366 #	NAS 1 26 167882	p 194	N83-20359* #	NASA-CR-169901	p 63	N83-19215* #
LA-9367-OBES	p 130	N83-21496 #	NAS 1 26 167890	p 81	N83-22756* #	NASA-CR-169902	p 63	N83-19220* #
LA-9424-MS	p 56	N83-16888 #	NAS 1 26 167961	p 177	N83-21056* #	NASA-CR-169911	p 115	N83-19216* #
LA-9488-MS	p 179	N83-21550 #	NAS 1 26 167963	p 114	N83-18924* #	NASA-CR-169912	p 115	N83-19217* #
LA-9526-MS	p 18	N83-18080 #	NAS 1 26 167976	p 181	N83-22739* #	NASA-CR-169919	p 64	N83-19225* #
LA-9541-MS	p 135	N83-21636 #	NAS 1 26 167983	p 166	N83-17424* #	NASA-CR-169920	p 63	N83-19219* #
LA-9558-HDR	p 136	N83-21703 #	NAS 1 26 168012	p 186	N83-16630* #	NASA-CR-169924	p 63	N83-19223* #
LA-9560-M	p 136	N83-21828 #	NAS 1 26 168027	p 105	N83-17728* #	NASA-CR-169928	p 64	N83-19224* #
			NAS 1 26 168049	p 162	N83-16343* #	NASA-CR-169933	p 114	N83-19183* #
LBL-11052	p 9	N83-16964 #	NAS 1 26 168079	p 169	N83-19228* #	NASA-CR-169938	p 63	N83-19222* #
LBL-12837	p 20	N83-18963 #	NAS 1 26 168080	p 117	N83-19812* #	NASA-CR-169945	p 174	N83-19273* #
LBL-12860	p 13	N83-17750 #	NAS 1 26 168107	p 177	N83-21508* #	NASA-CR-169974	p 20	N83-19227* #
LBL-13179-REV	p 14	N83-17889 #	NAS 1 26 168108	p 188	N83-22740* #	NASA-CR-170005	p 67	N83-20362* #
LBL-13179	p 14	N83-17886 #	NAS 1 26 168109	p 178	N83-21509* #	NASA-CR-170031	p 74	N83-21530* #
LBL-13399	p 6	N83-16885 #	NAS 1 26 168110	p 181	N83-22747* #	NASA-CR-170037	p 73	N83-21512* #
LBL-13584	p 8	N83-16955 #	NAS 1 26 169750	p 96	N83-16543* #	NASA-CR-170121	p 178	N83-21511* #
LBL-13586	p 9	N83-16961 #	NAS 1 26 169751	p 94	N83-16417* #	NASA-CR-170123	p 72	N83-21510* #
LBL-13650	p 66	N83-19627 #	NAS 1 26 169755	p 4	N83-16329* #	NASA-CR-170203	p 140	N83-22439* #
LBL-13807	p 142	N83-22568 #	NAS 1 26 169790	p 191	N83-16419* #	NASA-CR-170204	p 81	N83-22744* #
LBL-13905	p 99	N83-16841 #	NAS 1 26 169792	p 101	N83-16993* #	NASA-CR-170205	p 81	N83-22745* #
LBL-13937	p 133	N83-21587 #	NAS 1 26 169797	p 88	N83-16493* #	NASA-CR-170209	p 81	N83-22741* #
LBL-14019	p 124	N83-20414 #	NAS 1 26 169801	p 191	N83-16858* #	NASA-CR-170212	p 81	N83-22742* #
LBL-14192	p 176	N83-20422 #	NAS 1 26 169802	p 102	N83-17414* #	NASA-CR-170729	p 67	N83-20360* #
LBL-14358	p 33	N83-21617 #	NAS 1 26 169890	p 60	N83-17871* #			
LBL-14681	p 135	N83-21686 #	NAS 1 26 169899	p 63	N83-19221* #	NASA-TM-76933	p 163	N83-16855* #
LBL-14782	p 145	N83-22781 #	NAS 1 26 169901	p 63	N83-19215* #	NASA-TM-76957	p 96	N83-16525* #
LBL-14794	p 192	N83-16899 #	NAS 1 26 169902	p 63	N83-19220* #	NASA-TM-82960	p 166	N83-17423* #
			NAS 1 26 169911	p 115	N83-19216* #	NASA-TM-82997	p 24	N83-19651* #
LC-81-14053	p 194	N83-18904 #	NAS 1 26 169912	p 115	N83-19217* #	NASA-TM-83018	p 166	N83-18022* #
LC-81-83080	p 33	N83-21619 #	NAS 1 26 169919	p 64	N83-19225* #	NASA-TM-83019	p 123	N83-20361* #
LC-82-15038	p 25	N83-20363 #	NAS 1 26 169920	p 63	N83-19219* #	NASA-TM-83036	p 182	N83-22749* #
LC-82-600500	p 37	N83-23250 #	NAS 1 26 169924	p 63	N83-19223* #	NASA-TM-83046	p 163	N83-16857* #
LC-82-600508	p 117	N83-19310 #	NAS 1 26 169928	p 64	N83-19224* #	NASA-TM-83072	p 120	N83-19920* #
LC-82-600581	p 85	N83-22843 #	NAS 1 26 169933	p 114	N83-19183* #	NASA-TM-84631	p 187	N83-22541* #
			NAS 1 26 169938	p 63	N83-19222* #	NASA-TM-84951	p 60	N83-18023* #
LMSC-D843530	p 81	N83-22741* #	NAS 1 26 169945	p 174	N83-19273* #			
			NAS 1 26 169974	p 20	N83-19227* #	NASA-TP-2088	p 167	N83-18024* #
LUTMDC/TMVK-3095/1-24(1981)	p 6	N83-16923 #	NAS 1 26 170005	p 67	N83-20362* #			
M/B-M82 14	p 22	N83-19307 #	NAS 1 26 170031	p 74	N83-21530* #	NBS-BSS-147	p 85	N83-22843 #
			NAS 1 26 170037	p 73	N83-21512* #			
MA-RD-920-82069	p 98	N83-16564 #	NAS 1 26 170121	p 178	N83-21511* #	NBS-SP-631	p 117	N83-19310 #
			NAS 1 26 170123	p 72	N83-21510* #			
MAI-213	p 59	N83-16940 #	NAS 1 26 170203	p 140	N83-22439* #	NBS/GCR-82-397	p 59	N83-16940 #
			NAS 1 26 170204	p 81	N83-22744* #			
MASEC-SCR-81-093	p 71	N83-20410 #	NAS 1 26 170205	p 81	N83-22745* #	NBSIR-82-2487	p 84	N83-22841 #
MASEC-SCR-82-001	p 71	N83-20426 #	NAS 1 26 170209	p 81	N83-22741* #	NBSIR-82-2489	p 22	N83-19306 #
			NAS 1 26 170212	p 81	N83-22742* #	NBSIR-82-2531	p 194	N83-19308 #
MBB-UD-356-82-O	p 166	N83-17522 #	NAS 1 26 170729	p 67	N83-20360* #	NBSIR-82-2533	p 62	N83-18921 #
			NAS 1 55 2230	p 169	N83-19231* #	NBSIR-82-2540	p 165	N83-16938 #
MDC-G-8272-REV	p 65	N83-19295 #	NAS 1 55 2267	p 140	N83-22442* #	NBSIR-82-2583	p 84	N83-22840 #
MDC-G-9707-REV	p 75	N83-21551 #	NAS 1 60 2088	p 167	N83-18024* #			
						NEFES/83-11	p 147	N83-22844 #
ME-112(81)EMD-870-1	p 15	N83-18037 #	NASA-CASE-LAR-12958-1	p 60	N83-18025* #	NLH-NU-81-72-0002	p 162	N83-16556 #
MED-132	p 120	N83-19922 #	NASA-CASE-LEW-12253-1	p 186	N83-19596* #	NMSU/PSL-PS01010	p 64	N83-19276 #
			NASA-CASE-LEW-13414-1	p 68	N83-20374* #			
MIT-ARSL-TR-197-3	p 177	N83-21508* #	NASA-CASE-NPO-14565-2	p 89	N83-19826* #	NOAA-DR-ERL-PMEL-6	p 29	N83-20525 #
			NASA-CASE-NPO-15949-1	p 187	N83-20155* #			
MIT-ASRL-TR-197-2	p 181	N83-22740* #				NOAA-TM-OMPA-18	p 10	N83-16985 #
MIT-ASRL-TR-197-4	p 178	N83-21509* #	NASA-CP-2230	p 169	N83-19231* #			
MIT-ASRL-TR-197-5	p 181	N83-22747* #	NASA-CP-2267	p 140	N83-22442* #	NOAA-82072101	p 10	N83-16985 #
						NOAA-82072903	p 165	N83-16941 #
						NOAA-82092205	p 29	N83-20525 #
MIT-EL-81-047	p 19	N83-18109 #	NASA-CR-165127	p 163	N83-16859* #			
MIT-EL-82-016	p 67	N83-19917 #	NASA-CR-165148	p 4	N83-16341* #	NP-2901395	p 15	N83-18037 #
			NASA-CR-165326-VOL-1	p 143	N83-22750* #	NP-2902009	p 19	N83-18116 #
MIT-2295T9-18	p 181	N83-22484 #	NASA-CR-165326-VOL-2	p 143	N83-22751* #	NP-2902329	p 6	N83-16902 #
			NASA-CR-165326-VOL-3	p 144	N83-22754* #	NP-2902461	p 26	N83-20378 #
MLM-2871(OP)	p 168	N83-18511 #	NASA-CR-165472	p 182	N83-22748* #	NP-3900349	p 32	N83-21610 #
			NASA-CR-165491	p 169	N83-19226* #	NP-3900485	p 142	N83-22672 #
MR-82-14	p 196	N83-21629 #	NASA-CR-165566	p 181	N83-22746* #	NP-3900672	p 197	N83-22794 #
			NASA-CR-167882	p 194	N83-20359* #			
MTI-82TR-3	p 165	N83-16944 #	NASA-CR-167890	p 81	N83-22756* #			
			NASA-CR-167961	p 177	N83-21056* #	NSF-82-45	p 30	N83-21187 #
MTR-82W54	p 34	N83-21638 #	NASA-CR-167963	p 114	N83-18924* #			
			NASA-CR-167976	p 181	N83-22739* #	NSF/OIR-82002	p 128	N83-21091 #
NAEC-92-161	p 192	N83-16860 #	NASA-CR-167983	p 166	N83-17424* #			
			NASA-CR-168012	p 186	N83-16630* #	NSF/PRA-82010	p 30	N83-21187 #
NAS 1 15 76933	p 163	N83-16855* #	NASA-CR-168027	p 105	N83-17728* #	NSF/PRA-82012	p 28	N83-20438 #
NAS 1 15 76957	p 96	N83-16525* #	NASA-CR-168049	p 162	N83-16343* #			
NAS 1 15 82960	p 166	N83-17423* #	NASA-CR-168079	p 169	N83-19228* #			
NAS 1 15 82997	p 24	N83-19651* #	NASA-CR-168080	p 117	N83-19812* #	NSRDS-NBS-61-PT-5	p 194	N83-18904 #
NAS 1 15 83018	p 166	N83-18022* #	NASA-CR-168107	p 177	N83-21508* #			
NAS 1 15 83019	p 123	N83-20361* #	NASA-CR-168108	p 181	N83-22740* #	NSRP-NE-508	p 147	N83-22844 #

EPA-600/7-82-050

REPORT NUMBER INDEX

EPA-600/7-82-050	p 113	N83-18883	#	FOA-C-30290-E1	p 98	N83-16753	#	IRT-58	p 11	N83-17086	#
EPA-600/9-72-014	p 23	N83-19462	#		p 28	N83-20455	#	IS-T-1028	p 181	N83-22404	#
EPA-600/9-82-004	p 23	N83-19420	#	FWS/OBS-82/55	p 88	N83-17633	#	IS-4801	p 124	N83-20383	#
EPRI-AP-2098	p 110	N83-18052	#	GA-A-16610	p 115	N83-19230	#		p 14	N83-18017	#
EPRI-AP-2187	p 119	N83-19865	#	GAO/EMD-82-117	p 130	N83-21188	#	ISBN-0-11-411123-5	p 14	N83-18019	#
EPRI-AP-2202	p 77	N83-21579	#	GAO/EMD-82-117	p 162	N83-16343*	#	ISBN-0-11-411124-3	p 33	N83-21619	#
EPRI-AP-2214	p 139	N83-22362	#		p 166	N83-17424*	#	ISBN-0-309-03183-4	p 37	N83-23212	#
EPRI-AP-2235	p 137	N83-22339	#	GARRETT-21-4270-1 1				ISBN-0-7988-2507-3	p 25	N83-20363	#
EPRI-AP-2267	p 67	N83-20298	#	GARRETT-31-3725(4)	p 186	N83-16630*	#	ISBN-0-8330-0437-9	p 11	N83-17086	#
EPRI-AP-2328	p 139	N83-22361	#					ISBN-2-85782-094-1	p 14	N83-18021	#
EPRI-AP-2435-SY	p 59	N83-16920	#	GE-82SDS4222	p 197	N83-22785	#	ISBN-3-7045-0026-7	p 122	N83-20073	#
EPRI-AP-2473-VOL-1	p 82	N83-22791	#		p 107	N83-17754	#	ISBN-82-7267-397-5	p 67	N83-19962	#
EPRI-AP-2473-VOL-2	p 79	N83-21627	#	GEPP-TIS-696				ISBN-91-540-3709-3	p 59	N83-16939	#
EPRI-AP-2517	p 95	N83-16444	#		p 123	N83-20337	#	ISBN-91-540-3721-2	p 22	N83-19307	#
EPRI-AP-2550	p 177	N83-21366	#	GG-M-11781	p 115	N83-19196	#	ISBN-91-540-9134-9	p 123	N83-20342	#
EPRI-AP-2554	p 97	N83-16560	#					ISBN-91-7056-063-3			
EPRI-AP-2587	p 101	N83-16913	#	GJBX-193-82	p 99	N83-16844	#		p 167	N83-18030	#
EPRI-AP-2636	p 78	N83-21618	#	GJBX-20-82	p 115	N83-19197	#	ISD-291	p 166	N83-17905	#
EPRI-AP-2687-SY	p 75	N83-21558	#	GJBX-4-82	p 99	N83-16838	#	ISD-293			
EPRI-AP-2687	p 187	N83-22788	#	GJBX-413-81	p 115	N83-19196	#		p 14	N83-18018	#
				GJBX-6-82				ISSN-0-11-411122-7	p 11	N83-17086	#
EPRI-CS-2009-VOL-2	p 8	N83-16954	#		p 10	N83-16979	#	ISSN-0150-8997	p 166	N83-17905	#
EPRI-CS-2253	p 123	N83-20330	#	GKSS-80/E/57				ISSN-0170-6071	p 167	N83-18030	#
EPRI-EA-2153-VOL-1	p 113	N83-18554	#	GPO-11-221	p 25	N83-20370	#	ISSN-0170-6071	p 7	N83-16929	#
EPRI-EA-2157	p 23	N83-19334	#	GPO-11-308	p 169	N83-19229	#	ISSN-0340-7608	p 7	N83-16930	#
EPRI-EA-2324-VOL-1	p 187	N83-20399	#	GPO-95-066	p 35	N83-22753	#	ISSN-0340-7608	p 199	N83-17686	#
EPRI-EA-2324-VOL-3	p 187	N83-20400	#	GPO-97-481	p 26	N83-20373	#	ISSN-0340-7608	p 13	N83-17840	#
EPRI-EA-2447-SY	p 27	N83-20433	#	GPO-98-172	p 36	N83-22846	#	ISSN-0340-7608	p 13	N83-17841	#
EPRI-EA-2658	p 131	N83-21499	#	GPO-98-550	p 175	N83-20372	#	ISSN-0340-7608	p 13	N83-17842	#
				GPO-98-637	p 25	N83-20371	#	ISSN-0340-7608	p 15	N83-18026	#
EPRI-EM-2131	p 5	N83-16655	#	GPO-98-702	p 24	N83-19923	#	ISSN-0340-7608	p 15	N83-18027	#
EPRI-EM-2173	p 103	N83-17647	#	GPO-99-464	p 35	N83-22752	#	ISSN-0340-7608	p 109	N83-18031	#
EPRI-EM-2193-VOL-2	p 66	N83-19330	#	GPO-99-627	p 25	N83-20369	#	ISSN-0340-7608	p 109	N83-18032	#
EPRI-EM-2210-VOL-6	p 196	N83-21580	#	GPO-99-628	p 24	N83-20002	#	ISSN-0340-7608	p 186	N83-18033	#
EPRI-EM-2260	p 198	N83-22836	#	GPO-99-651	p 25	N83-20364	#	ISSN-0340-7608	p 109	N83-18034	#
EPRI-EM-2351-VOL-3-PT-1	p 192	N83-16869	#	GPO-99-663	p 25	N83-20367	#	ISSN-0340-7608	p 111	N83-18123	#
EPRI-EM-2351-VOL-3-PT-2	p 194	N83-18074	#	GPO-99-748	p 25	N83-20151	#	ISSN-0340-7608	p 168	N83-18172	#
EPRI-EM-2351-VOL-5-PT-1	p 197	N83-22759	#	GPO-99-879	p 123	N83-20366	#	ISSN-0340-7608	p 125	N83-21052	#
EPRI-EM-2351-VOL-5-PT-2	p 197	N83-22758	#	GPO-99-979	p 123	N83-20365	#	ISSN-0340-7608	p 125	N83-21053	#
EPRI-EM-2573-VOL-1-EXEC-SUMM	p 193	N83-16919	#		p 143	N83-22751*	#	ISSN-0340-7608	p 126	N83-21054	#
EPRI-EM-2579	p 193	N83-16918	#	GR/DC-625RL137-VOL-2	p 143	N83-22750*	#	ISSN-0340-7608	p 131	N83-21505	#
				GR/DC-625RN209-VOL-1				ISSN-0340-7608	p 131	N83-21506	#
EPRI-NP-2174	p 168	N83-19099	#		p 144	N83-22754*	#	ISSN-0340-7608	p 131	N83-21507	#
EPRI-NP-2269	p 162	N83-16515	#	GRDC-625-RL-153-VOL-3				ISSN-0347-4348	p 22	N83-19307	#
					p 84	N83-22842	#	ISSN-0379-6566	p 176	N83-21006	#
EPRI-RD-2143-SR	p 105	N83-17707	#	GRI-79/0117	p 72	N83-20441	#	ISSN-0397-4075	p 73	N83-21514	#
				GRI-80-0016	p 96	N83-16461	#	ISSN-0731-6291	p 199	N83-16891	#
EPRI-903143	p 29	N83-20744	#	GRI-80/0108	p 164	N83-16932	#		p 64	N83-19279	#
EPRI/EA-2358-VOL-1	p 121	N83-19943	#	GRI-80/0137	p 67	N83-19963	#	ISU-ERI-AMES-83057			
				GRI-80/0138	p 55	N83-16710	#		p 165	N83-16937	#
ERLN-X36	p 113	N83-18880	#	GRI-80/0139	p 28	N83-20442	#	JHU/APL/OQR/82-1			
				GRI-80/0147	p 176	N83-20437	#		p 64	N83-19224*	#
ESA-CR(P)-1646	p 73	N83-21513	#	GRI-80/0162	p 147	N83-22904	#	JPL-PUB-82-103	p 64	N83-19225*	#
				GRI-81-0025 4	p 184	N83-22839	#	JPL-PUB-82-109	p 101	N83-16993*	#
ESA-SP-186	p 176	N83-21006	#	GRI-81/00095	p 66	N83-19312	#	JPL-PUB-82-14	p 191	N83-16419*	#
				GRI-81/0017	p 147	N83-22903	#	JPL-PUB-82-75	p 191	N83-16858*	#
ESA-STM-225	p 73	N83-21514	#	GRI-81/0025 2	p 147	N83-22896	#	JPL-PUB-82-91	p 63	N83-19223*	#
				GRI-81/0025 5	p 125	N83-20440	#	JPL-PUB-82-94	p 114	N83-19183*	#
ESA-TT-807	p 73	N83-21515	#	GRI-81/0031	p 28	N83-20439	#	JPL-PUB-82-99	p 72	N83-21510*	#
				GRI-81/0034	p 120	N83-19881	#	JPL-PUB-83-1			
ESD-PUBL-1828-6	p 22	N83-19329	#	GRI-81/0035	p 8	N83-16947	#		p 178	N83-21511*	#
				GRI-81/0059	p 22	N83-19314	#	JPL-PUBL-83-7			
ESG-DOE-13384	p 126	N83-21077	#	GRI-81/0060	p 62	N83-18967	#		p 64	N83-19225*	#
ESG-DOE-13390	p 127	N83-21085	#	GRI-81/0063	p 62	N83-18968	#	JPL-5101-202	p 64	N83-19224*	#
				GRI-81/0064	p 122	N83-19946	#	JPL-5105-113	p 63	N83-19223*	#
ESL-98-VOL-1	p 135	N83-21628	#	GRI-81/0080	p 142	N83-22470	#	JPL-5106-25	p 63	N83-19219*	#
				GRI-81/0096	p 147	N83-22845	#	JPL-9950-774	p 81	N83-22742*	#
ETEC-TDR-82-13	p 83	N83-22798	#	GRI-82/0010	p 165	N83-16944	#	JPL-9950-806	p 81	N83-22745*	#
				GRI-82/0014				JPL-9950-810			
EUR-6936	p 193	N83-16949	#	GSRMP-13	p 135	N83-21686	#	JPRS-82608	p 89	N83-17757	#
EUR-7065-68	p 193	N83-16933	#		p 146	N83-22803	#	JPRS-82686	p 199	N83-17761	#
EUR-7163-FR	p 59	N83-16936	#	HEDL-TME-81-47							
					p 135	N83-21621	#	JUEL-SPEZ-138	p 163	N83-16855*	#
FAA-CT-82-93	p 120	N83-19322	#	HN-00020-1098					p 168	N83-18451	#
					p 177	N83-21246	#	KAERI/RR-275/80			
FCR-3859	p 28	N83-20439	#	HTGL-229				K05-01-82-FR	p 63	N83-19215*	#
FCR-4111A	p 176	N83-20437	#	IAP-TR-82-2	p 194	N83-19277	#		p 167	N83-18024*	#
								L-15495			
FE-2013-19	p 139	N83-22363	#	IDO-10110	p 132	N83-21523	#		p 109	N83-18015	#
FE-2034-28	p 126	N83-21068	#		p 23	N83-19340	#	LA-UR-81-1785	p 194	N83-18591	#
FE-2044-52	p 126	N83-21077	#	IERL-RTP-P-519				LA-UR-81-3071	p 9	N83-16971	#
FE-2434-68	p 121	N83-19941	#		p 23	N83-19356	#	LA-UR-81-3252	p 61	N83-18050	#
FE-2893-79	p 12	N83-17673	#	IERL-RTP-1289				LA-UR-81-3610	p 16	N83-18040	#
FE-2893-83	p 118	N83-19862	#		p 14	N83-18021	#	LA-UR-81-3619	p 16	N83-18042	#
FE-2893-97	p 117	N83-19827	#	IASA-RR-81-35				LA-UR-81-3641	p 104	N83-17652	#
					p 181	N83-22746*	#	LA-UR-82-113	p 108	N83-18014	#
FFA-TN-1982-19	p 167	N83-18028	#	IITRI-M06066-22				LA-UR-82-1272	p 168	N83-18512	#
					p 112	N83-18138	#	LA-UR-82-207	p 108	N83-18010	#
FHWA/RD-80/183-VOL-3	p 148	N83-22949	#	IL/SGS/CIRC-525				LA-UR-82-452	p 145	N83-22775	#
					p 142	N83-22594	#	LA-UR-82-518	p 7	N83-16925	#
FOA-B-60003-M7	p 107	N83-17999	#	INPE-2645-TDL/116				LA-UR-82-522			
FOA-B-60003-M7	p 123	N83-20342	#								

REPORT NUMBER INDEX

EPA-600/7-82-049

DOE/ET-10104/38-PT-3-PT-4	p 104	N83-17657 #	DOE/LC-RI-82-2-PT-3	p 108	N83-18008 #	DOE/RA-23211/3	p 182	N83-22780 #
DOE/ET-10143/T10	p 106	N83-17732 #	DOE/LC-RI-82-5	p 136	N83-21702 #	DOE/RA-50075/T14	p 31	N83-21545 #
DOE/ET-10154/96	p 137	N83-22337 #	DOE/LC-RI-82/1	p 112	N83-18137 #	DOE/RA-50075/T5	p 17	N83-18064 #
DOE/ET-10159/T21	p 34	N83-21651 #				DOE/RA-50075/T6	p 17	N83-18065 #
DOE/ET-10163/68	p 121	N83-19941 #				DOE/RA-50076/10	p 135	N83-21641 #
DOE/ET-10340/127-VOL-5	p 181	N83-22607 #	DOE/LC-10417/T1	p 122	N83-19998 #	DOE/RA-50091/T1	p 35	N83-22782 #
DOE/ET-10495/28	p 126	N83-21068 #				DOE/RA-50274/1	p 183	N83-22784 #
DOE/ET-10518/T4	p 127	N83-21078 #	DOE/LC/RI-82/6	p 137	N83-22350 #	DOE/RA-50282/T1	p 183	N83-22832 #
DOE/ET-10699/T1	p 128	N83-21127 #				DOE/RA-50338/1-VOL-2-ATTACH-		
DOE/ET-10703/1301	p 117	N83-19829 #	DOE/MC-08386/T1	p 108	N83-18013 #	A	p 147	N83-22829 #
DOE/ET-12548/15	p 101	N83-16993* #	DOE/MC-12735/1251	p 90	N83-22352 #	DOE/RA-50381/1156-VOL-1	p 119	N83-19872 #
DOE/ET-13005/T13	p 104	N83-17676 #	DOE/MC-14380/1210-VOL-2	p 119	N83-19868 #	DOE/RA-50381/1156-VOL-2	p 119	N83-19873 #
DOE/ET-14700/9	p 119	N83-19870 #	DOE/MC-14380/1210-VOL-3	p 119	N83-19869 #	DOE/RA-50381/1156-VOL-3	p 120	N83-19874 #
DOE/ET-14759/T1-VOL-1	p 97	N83-16559 #	DOE/MC-16024/T4	p 138	N83-22357 #			
DOE/ET-14881/8	p 105	N83-17677 #	DOE/MC-16026/2	p 139	N83-22358 #	DOE/RS-10225/T2	p 65	N83-19285 #
DOE/ET-15234/T1	p 168	N83-19102 #	DOE/MC-16220/T3	p 167	N83-18084 #			
DOE/ET-15352/T1	p 176	N83-20421 #	DOE/MC-16220/1306	p 183	N83-22787 #	DOE/R5-10222/1	p 102	N83-17051 #
DOE/ET-20279-158	p 58	N83-16908 #	DOE/MC-16242-1	p 163	N83-16864 #	DOE/R5-10296/T1	p 75	N83-21557 #
DOE/ET-20279-224	p 55	N83-16871 #	DOE/MC-16481/1201-VOL-1	p 113	N83-18328 #	DOE/R5-10298/1	p 81	N83-22567 #
DOE/ET-20279-168	p 71	N83-20416 #	DOE/MC-16481/1201-VOL-2	p 112	N83-18327 #	DOE/R5-10316-T1	p 141	N83-22462 #
DOE/ET-20279/174	p 61	N83-18044 #	DOE/MC-16481/1202-VOL-1	p 112	N83-18326 #			
DOE/ET-20279/199	p 55	N83-16872 #	DOE/MC-16481/1202-VOL-2	p 112	N83-18325 #	DOE/SAN-1556/5	p 105	N83-17726 #
DOE/ET-20279/210	p 57	N83-16898 #	DOE/MC-16481/1203-VOL-1	p 113	N83-18329 #			
DOE/ET-20279/215	p 80	N83-22534 #	DOE/MC-18668/1186	p 138	N83-22356 #	DOE/SF-00700/T4	p 72	N83-21202 #
DOE/ET-20279/218	p 78	N83-21607 #	DOE/MC-19331/1321	p 128	N83-21088 #	DOE/SF-01863/1	p 18	N83-18108 #
DOE/ET-20279/223	p 55	N83-16873 #				DOE/SF-10499/116-REV	p 65	N83-19295 #
DOE/ET-20279/225	p 72	N83-21200 #	DOE/METC-SP-188	p 126	N83-21069 #	DOE/SF-10499/83-REV	p 75	N83-21551 #
DOE/ET-20622/T1	p 27	N83-20427 #	DOE/METC-82/49	p 147	N83-22825 #	DOE/SF-11492-T5	p 58	N83-16914 #
DOE/ET-20624/T1	p 68	N83-20384 #				DOE/SF-11492-T6	p 58	N83-16909 #
DOE/ET-23025/26	p 124	N83-20415 #	DOE/NASA-0202-1	p 169	N83-19228* #	DOE/SF-11492-T7	p 65	N83-19296 #
DOE/ET-23043/T2	p 68	N83-20382 #				DOE/SF-11526/T1	p 74	N83-21542 #
DOE/ET-26602/35	p 196	N83-21624 #	DOE/NASA/DEN-175-1-VOL-1	p 143	N83-22750* #	DOE/TIC-4583/R3	p 200	N83-20821 #
DOE/ET-27014/T2	p 145	N83-22789 #	DOE/NASA/DEN-175-1-VOL-2	p 143	N83-22751* #			
DOE/ET-27034/T2	p 116	N83-19299 #	DOE/NASA/DEN-175-1-VOL-3	p 144	N83-22754* #	DOE/TIC/EGC-81	p 199	N83-16892 #
DOE/ET-27135/T1	p 110	N83-18066 #				DOE/TIC/EGC-82/1	p 199	N83-16891 #
DOE/ET-27146/T17	p 135	N83-21632 #	DOE/NASA/0129-1	p 169	N83-19226* #	DOE/TIC/EGC-82/3	p 35	N83-22792 #
DOE/ET-27204/T1-VOL-1-SECT-1	p 145	N83-22790 #	DOE/NASA/0136-1	p 182	N83-22748* #			
DOE/ET-27204/T1-VOL-1-SECT-2	p 134	N83-21609 #	DOE/NASA/0136-1	p 163	N83-16859* #	DOT-HS-806-107	p 30	N83-20844 #
DOE/ET-27204/T1-VOL-1-SECT-3	p 136	N83-21701 #	DOE/NASA/0167-82/2/4	p 166	N83-17424* #	DOT-HS-806-179	p 5	N83-16766 #
DOE/ET-27204/T1-VOL-2-SECT-4	p 143	N83-22698 #	DOE/NASA/0182-1	p 181	N83-22746* #	DOT-HS-806-188-VOL-1	p 30	N83-20845 #
DOE/ET-27207/T1-VOL-2-SECT-3	p 143	N83-22697 #	DOE/NASA/0251-1	p 194	N83-20359* #			
DOE/ET-27242/T2	p 133	N83-21588 #	DOE/NASA/10350-35	p 123	N83-20361* #	DOT/FAA-CT-82/131	p 94	N83-16353 #
DOE/ET-27256/T13	p 134	N83-21590 #	DOE/NASA/20320-42	p 163	N83-16857* #			
DOE/ET-27256/T14	p 133	N83-21589 #	DOE/NASA/3249-1	p 117	N83-19812* #	DOT/FAA/RD-82/80	p 94	N83-16353 #
DOE/ET-27256/T23	p 134	N83-21595 #	DOE/NASA/3303-1	p 181	N83-22740* #			
DOE/ET-27256/T25	p 134	N83-21594 #	DOE/NASA/3303-2	p 177	N83-21508* #	DP-1648	p 129	N83-21171 #
DOE/ET-27256/T26	p 32	N83-21593 #	DOE/NASA/3303-3	p 178	N83-21509* #			
DOE/ET-27256/T31	p 134	N83-21592 #	DOE/NASA/3303-4	p 181	N83-22747* #	DPST-82-842	p 137	N83-21934 #
DOE/ET-28317/T2	p 128	N83-21136 #	DOE/NASA/51040-42	p 166	N83-17423* #			
DOE/ET-28365/17	p 110	N83-18073 #	DOE/NASA/51040-42	p 24	N83-19651* #	DRD-SE-2	p 63	N83-19221* #
DOE/ET-29100/21-VOL-1	p 164	N83-16915 #	DOE/NASA/51044-29	p 182	N83-22749* #			
DOE/ET-29163/1	p 186	N83-18102 #				DRL-157	p 63	N83-19221* #
DOE/ET-29185/21	p 177	N83-21247 #				DRL-175	p 63	N83-19220* #
DOE/ET-29299-1	p 5	N83-16653 #	DOE/NBM-1002	p 127	N83-21084 #			
DOE/ET-29354/3	p 187	N83-22529 #	DOE/NBM-2013435	p 27	N83-20423 #	DTH-LET-RE-81-1	p 106	N83-17735 #
			DOE/NBM-2013508	p 121	N83-19939 #			
DOE/ET/27125-T1-VOL-1	p 163	N83-16867 #	DOE/NE-0032	p 19	N83-18555 #	D10-1982	p 59	N83-16939 #
DOE/ET/27125-T1-VOL-1						D8 1982	p 67	N83-19962 #
DOE/EV-01340/4	p 31	N83-21525 #	DOE/NV-10177/1	p 110	N83-18070 #			
DOE/EV-10131/8	p 16	N83-18041 #				E-1260	p 140	N83-22442* #
DOE/FC-10291/T1	p 95	N83-16439 #	DOE/OR-03054/T13-VOL-2	p 127	N83-21086 #	E-1377	p 166	N83-17423* #
						E-1430	p 24	N83-19651* #
DOE/FE-05110-T2	p 108	N83-18007 #	DOE/PC-30013/T2-PT-1	p 118	N83-19860 #	E-1453	p 166	N83-18022* #
DOE/FE-05147/T2	p 105	N83-17678 #	DOE/PC-30018/6	p 127	N83-21085 #	E-1455	p 123	N83-20361* #
DOE/FE-10742/44	p 138	N83-22355 #	DOE/PC-30019/T2	p 121	N83-19940 #	E-1479	p 182	N83-22749* #
DOE/FE-15078/1	p 179	N83-21549 #	DOE/PC-30142/T3	p 118	N83-19854 #	E-1493	p 163	N83-16857* #
DOE/FE-15086/1	p 183	N83-22827 #	DOE/PC-30216/T3	p 102	N83-17639 #	E-1544	p 120	N83-19920* #
			DOE/PC-30219/T2	p 104	N83-17655 #			
DOE/GFETC/RI-82/5	p 146	N83-22824 #	DOE/PC-30230/23	p 102	N83-17638 #	EEB-VENT-82-14	p 33	N83-21617 #
			DOE/PC-30231/3	p 111	N83-18101 #			
DOE/IA-0010/17	p 26	N83-20405 #	DOE/PC-30249/T3	p 148	N83-23190 #	EGG-HYD-6024	p 125	N83-20434 #
			DOE/PC-30291/5	p 95	N83-16445 #			
DOE/ID-12079/71-VOL-1	p 135	N83-21628 #	DOE/PC-30301/5	p 103	N83-17641 #	EGG-M-01581	p 164	N83-16901 #
DOE/ID-12172/T1	p 100	N83-16874 #	DOE/PC-30302/5	p 118	N83-19858 #	EGG-M-03182	p 104	N83-17661 #
DOE/ID-12274/T1-VOL-1	p 132	N83-21531 #	DOE/PC-30306-T6	p 29	N83-20457 #			
DOE/ID-12274/T1-VOL-2	p 132	N83-21532 #	DOE/PC-40278/T1	p 96	N83-16549 #	EGG-1183-1785	p 98	N83-16834 #
DOE/ID-12274/T1-VOL-3	p 132	N83-21533 #	DOE/PC-40781/T2	p 139	N83-22363 #	EGG-2185	p 133	N83-21586 #
DOE/ID-12274/T1-VOL-4	p 133	N83-21535 #	DOE/PC-40782/T1	p 118	N83-19853 #	EGG-2193	p 100	N83-16893 #
DOE/ID-12274/T1-VOL-5	p 133	N83-21534 #	DOE/PC-40782/T3	p 126	N83-21071 #			
DOE/ID-12274/T1-VOL-6	p 129	N83-21173 #	DOE/PC-40783/T5	p 95	N83-16446 #	EMD-2-68-1106	p 15	N83-18037 #
DOE/ID-12314/T1	p 178	N83-21544 #	DOE/PC-40785/3	p 138	N83-22354 #			
DOE/ID-12325/4	p 145	N83-22793 #	DOE/PC-41755/7	p 97	N83-16562 #	ENERGY-AUDIT-SER-16	p 14	N83-18020 #
DOE/ID-12329/T1	p 114	N83-19101 #	DOE/PC-42268/T2	p 113	N83-18416 #			
			DOE/PC-42294/T1	p 97	N83-16561 #	EP-49	p 14	N83-18018 #
			DOE/PC-50041/2	p 137	N83-22342 #			
DOE/JPL-1012-79	p 64	N83-19225* #				EPA-000/9-82-0098	p 22	N83-19313 #
DOE/JPL-1060-56	p 63	N83-19223* #	DOE/PE-0029/1	p 5	N83-16870 #	EPA-460/3-82-004	p 149	N83-23249 #
DOE/JPL-1060/57	p 64	N83-19224* #	DOE/PE-0042	p 28	N83-20451 #	EPA-460/3-82-009	p 36	N83-22867 #
DOE/JPL-12548/16	p 114	N83-19183* #	DOE/PE-70228/1	p 16	N83-18039 #	EPA-600/D-82-326	p 23	N83-19340 #
DOE/JPL-954355/81-21	p 63	N83-19219* #	DOE/PE-70326-2	p 25	N83-20334 #	EPA-600/2-82-070A-VOL-1	p 29	N83-20459 #
DOE/JPL-955909-82/8	p 63	N83-19221* #				EPA-600/2-82-070B-VOL-2	p 29	N83-20469 #
DOE/JPL-955986-4	p 63	N83-19222* #	DOE/PETC-TR-82/3	p 95	N83-16429 #	EPA-600/3-82-012	p 113	N83-18880 #
DOE/JPL-956046-82/5	p 81	N83-22744* #				EPA-600/3-82-066	p 165	N83-16935 #
DOE/JPL-956205-82/2	p 63	N83-19220* #	DOE/PETC/TR-82/11	p 119	N83-19866 #	EPA-600/7-82-027	p 96	N83-16460 #
DOE/JPL-956312-83/02	p 81	N83-22745* #	DOE/PETC/TR-82/5	p 103	N83-17640 #	EPA-600/7-82-049	p 23	N83-19356 #

DE83-000848	p 97	N83-16559 #	DE83-003134	p 76	N83-21560 #	DE83-900806	p 83	N83-22818 #
DE83-000860	p 130	N83-21494 #	DE83-003137	p 68	N83-20384 #	DE83-900807	p 82	N83-22795 #
DE83-000884	p 102	N83-17028 #	DE83-003143	p 180	N83-22030 #	DE83-900823	p 83	N83-22809 #
DE83-000937	p 31	N83-21538 #	DE83-003146	p 196	N83-21528 #	DE83-900824	p 78	N83-21614 #
DE83-000943	p 31	N83-21536 #	DE83-003147	p 184	N83-23243 #	DE83-900875	p 146	N83-22807 #
DE83-000944	p 136	N83-21723 #	DE83-003148	p 20	N83-19289 #			
DE83-000962	p 101	N83-16910 #	DE83-003156	p 182	N83-22780 #	DFVLR-FB-82-27	p 73	N83-21515 #
DE83-000987	p 127	N83-21086 #	DE83-003166	p 132	N83-21529 #			
DE83-001016	p 21	N83-19294 #	DE83-003187	p 79	N83-21626 #	DGLR PAPER 82-081	p 152	A83-24202 #
DE83-001023	p 74	N83-21542 #	DE83-003196	p 33	N83-21630 #	DGLR PAPER 82-082	p 151	A83-24194 #
DE83-001046	p 90	N83-22352 #	DE83-003215	p 143	N83-22698 #	DGLR PAPER 82-083	p 152	A83-24195 #
DE83-001068	p 58	N83-16911 #	DE83-003219	p 136	N83-21701 #	DGLR PAPER 82-084	p 152	A83-24196 #
DE83-001098	p 127	N83-21078 #	DE83-003222	p 143	N83-22697 #			
DE83-001111	p 21	N83-19291 #	DE83-003234	p 145	N83-22790 #	DOE/AF-92006/T1	p 122	N83-19944 #
DE83-001112	p 21	N83-19292 #	DE83-003235	p 134	N83-21609 #			
DE83-001118	p 177	N83-21247 #	DE83-003301	p 68	N83-20381 #	DOE/AL-16223/2	p 77	N83-21583 #
DE83-001145	p 126	N83-21077 #	DE83-003305	p 180	N83-21622 #			
DE83-001149	p 177	N83-21246 #	DE83-003306	p 145	N83-22781 #	DOE/BC-10106-26	p 99	N83-16839 #
DE83-001165	p 147	N83-22829 #	DE83-003317	p 79	N83-21625 #	DOE/BC-10106/28	p 115	N83-19198 #
DE83-001252	p 194	N83-18074 #	DE83-003332	p 129	N83-21172 #	DOE/BC-10449/1	p 122	N83-20171 #
DE83-001255	p 195	N83-20380 #	DE83-003333	p 132	N83-21524 #			
DE83-001278	p 80	N83-21642 #	DE83-003339	p 79	N83-21620 #	DOE/BETC-SP-82/6	p 123	N83-20333 #
DE83-001353	p 125	N83-20434 #	DE83-003341	p 79	N83-21635 #			
DE83-001384	p 114	N83-19101 #	DE83-003344	p 117	N83-19829 #	DOE/BETC/IC-82/4-REV	p 30	N83-21156 #
DE83-001407	p 178	N83-21544 #	DE83-003390	p 137	N83-22342 #			
DE83-001421	p 74	N83-21539 #	DE83-003426	p 197	N83-22785 #	DOE/BETC/PPS-82/1	p 121	N83-19924 #
DE83-001433	p 145	N83-22789 #	DE83-003582	p 126	N83-21068 #			
DE83-001439	p 30	N83-21156 #	DE83-003612	p 31	N83-21525 #	DOE/BETC/QPR-82/2	p 121	N83-19937 #
DE83-001465	p 75	N83-21557 #	DE83-003616	p 126	N83-21069 #			
DE83-001493	p 174	N83-19398 #	DE83-003628	p 187	N83-22786 #	DOE/BETC/RI-82/4	p 96	N83-16550 #
DE83-001576	p 145	N83-22769 #	DE83-003630	p 178	N83-21526 #			
DE83-001579	p 18	N83-18081 #	DE83-003668	p 78	N83-21606 #	DOE/CE-0035	p 31	N83-21536 #
DE83-001636	p 9	N83-16972 #	DE83-003669	p 79	N83-21634 #	DOE/CE-50179/1-VOL-1	p 130	N83-21185 #
DE83-001637	p 126	N83-21076 #	DE83-003753	p 195	N83-21527 #	DOE/CE-50179/1-VOL-2	p 142	N83-22467 #
DE83-001638	p 65	N83-19295 #	DE83-003801	p 73	N83-21517 #	DOE/CE-50179/1-VOL-3	p 142	N83-22468 #
DE83-001670	p 75	N83-21551 #	DE83-003817	p 124	N83-20383 #			
DE83-001683	p 84	N83-22822 #	DE83-003821	p 183	N83-22787 #	DOE/CH-10064/5	p 195	N83-20376 #
DE83-001684	p 192	N83-16875 #	DE83-003834	p 129	N83-21171 #	DOE/CH-10116/1	p 83	N83-22808 #
DE83-001701	p 122	N83-19945 #	DE83-003849	p 74	N83-21522 #			
DE83-001706	p 167	N83-18079 #	DE83-003935	p 72	N83-21200 #	DOE/CS-14287/T2	p 80	N83-21642 #
DE83-001715	p 75	N83-21547 #	DE83-003993	p 136	N83-21828 #	DOE/CS-20175/1	p 138	N83-22353 #
DE83-001783	p 31	N83-21545 #	DE83-004004	p 197	N83-22758 #	DOE/CS-20232/2	p 179	N83-21577 #
DE83-001839	p 80	N83-21722 #	DE83-004005	p 197	N83-22759 #	DOE/CS-20233/1	p 28	N83-20435 #
DE83-001850	p 137	N83-22336 #	DE83-004066	p 132	N83-21523 #	DOE/CS-20291/3	p 145	N83-22769 #
DE83-001852	p 10	N83-16973 #	DE83-004095	p 135	N83-21686 #	DOE/CS-24456/2	p 146	N83-22812 #
DE83-001857	p 135	N83-21632 #	DE83-004146	p 182	N83-22771 #	DOE/CS-28458/T1	p 24	N83-19950 #
DE83-001868	p 35	N83-22792 #	DE83-004160	p 183	N83-22810 #	DOE/CS-30284/T2	p 68	N83-20381 #
DE83-002017	p 197	N83-22804 #	DE83-004228	p 80	N83-22407 #	DOE/CS-30401/1	p 6	N83-16903 #
DE83-002057	p 198	N83-22805 #	DE83-004237	p 131	N83-21519 #	DOE/CS-30574/T1	p 73	N83-21521 #
DE83-002059	p 198	N83-22806 #	DE83-004239	p 73	N83-21518 #	DOE/CS-30574/T2	p 74	N83-21530 #
DE83-002096	p 129	N83-21176 #	DE83-004272	p 82	N83-22796 #	DOE/CS-30584/2	p 33	N83-21616 #
DE83-002121	p 32	N83-21561 #	DE83-004294	p 182	N83-22772 #	DOE/CS-30632/3	p 70	N83-20402 #
DE83-002134	p 183	N83-22817 #	DE83-004299	p 182	N83-22773 #	DOE/CS-30634/1	p 70	N83-20401 #
DE83-002136	p 78	N83-21613 #	DE83-004320	p 146	N83-22821 #	DOE/CS-31499/T2	p 75	N83-21555 #
DE83-002139	p 74	N83-21541 #	DE83-004330	p 181	N83-22607 #	DOE/CS-34155-T1	p 58	N83-16916 #
DE83-002167	p 127	N83-21085 #	DE83-004372	p 183	N83-22820 #	DOE/CS-34383/A002	p 78	N83-21604 #
DE83-002192	p 62	N83-18072 #	DE83-004454	p 85	N83-22856 #	DOE/CS-40051/1	p 15	N83-18036 #
DE83-002205	p 196	N83-21639 #	DE83-004458	p 28	N83-20435 #	DOE/CS-40035/T1	p 32	N83-21578 #
DE83-002226	p 117	N83-19827 #	DE83-004475	p 80	N83-21637 #	DOE/CS-50005/T1-APP-A-B	p 129	N83-21175 #
DE83-002236	p 83	N83-22798 #	DE83-004477	p 82	N83-22797 #	DOE/CS-50005/T1-APP-C-F	p 130	N83-21178 #
DE83-002270	p 196	N83-21624 #	DE83-004480	p 136	N83-21703 #	DOE/CS-50005/T1-APP-G-H	p 130	N83-21177 #
DE83-002276	p 195	N83-20430 #	DE83-004520	p 33	N83-21616 #	DOE/CS-50005/T1-SUMM	p 129	N83-21174 #
DE83-002277	p 196	N83-21629 #	DE83-004579	p 141	N83-22462 #	DOE/CS-50017/3	p 129	N83-21172 #
DE83-002284	p 198	N83-23244 #	DE83-004752	p 33	N83-21617 #	DOE/CS-50020/1	p 104	N83-17670 #
DE83-002310	p 56	N83-16888 #	DE83-004763	p 84	N83-22819 #	DOE/CS-50048/T1	p 141	N83-22461 #
DE83-002312	p 18	N83-18080 #	DE83-004800	p 83	N83-22808 #	DOE/CS-50108/1	p 37	N83-23245 #
DE83-002319	p 111	N83-18075 #	DE83-004801	p 187	N83-22529 #	DOE/CS-50134/T1	p 20	N83-18592 #
DE83-002343	p 66	N83-19297 #	DE83-004819	p 128	N83-21088 #	DOE/CS-54209/10	p 191	N83-16858 #
DE83-002436	p 33	N83-21612 #	DE83-004854	p 181	N83-22404 #	DOE/CS-56051/6	p 89	N83-21183 #
DE83-002446	p 32	N83-21553 #	DE83-004873	p 37	N83-23245 #	DOE/CS-60055/T2	p 32	N83-21561 #
DE83-002455	p 31	N83-21552 #	DE83-004935	p 34	N83-21638 #	DOE/CS-80002/T1-VOL-1	p 21	N83-19291 #
DE83-002463	p 27	N83-20429 #	DE83-004949	p 146	N83-22812 #	DOE/CS-80002/T1-VOL-2	p 21	N83-19292 #
DE83-002490	p 180	N83-21623 #	DE83-005011	p 145	N83-22793 #	DOE/CS-90024/1	p 21	N83-19294 #
DE83-002501	p 121	N83-19937 #	DE83-005045	p 137	N83-21934 #			
DE83-002529	p 78	N83-21605 #	DE83-005308	p 135	N83-21641 #	DOE/EIA-0304	p 127	N83-21079 #
DE83-002532	p 78	N83-21607 #	DE83-005708	p 197	N83-21640 #	DOE/EIA-0326	p 27	N83-20424 #
DE83-002547	p 128	N83-21127 #	DE83-005987	p 128	N83-21089 #	DOE/EIA-0327	p 24	N83-19957 #
DE83-002549	p 32	N83-21559 #	DE83-005995	p 80	N83-21643 #			
DE83-002565	p 141	N83-22461 #	DE83-013435	p 27	N83-20423 #	DOE/EP-0025	p 64	N83-19281 #
DE83-002589	p 33	N83-21611 #	DE83-900088	p 89	N83-22349 #			
DE83-002593	p 177	N83-21075 #	DE83-900162	p 75	N83-21546 #	DOE/ER-0123-VOL-2	p 26	N83-20419 #
DE83-002609	p 180	N83-21608 #	DE83-900192	p 177	N83-21366 #	DOE/ER-04263/5	p 76	N83-21560 #
DE83-002633	p 136	N83-21694 #	DE83-900279	p 101	N83-16913 #	DOE/ER-04749/T1	p 70	N83-20408 #
DE83-002646	p 74	N83-21537 #	DE83-900303	p 34	N83-21650 #	DOE/ER-05003/016	p 67	N83-19917 #
DE83-002771	p 33	N83-21619 #	DE83-900349	p 32	N83-21610 #	DOE/ER-05947/3	p 140	N83-22436 #
DE83-002860	p 83	N83-22799 #	DE83-900406	p 28	N83-20455 #	DOE/ER-10159/T1	p 33	N83-21619 #
DE83-002862	p 183	N83-22784 #	DE83-900473	p 34	N83-21666 #	DOE/ER-10343/04	p 196	N83-21639 #
DE83-002882	p 180	N83-21633 #	DE83-900485	p 142	N83-22672 #	DOE/ER-10519/T1	p 70	N83-20407 #
DE83-002895	p 135	N83-21631 #	DE83-900531	p 75	N83-21558 #	DOE/ER-10677/2	p 120	N83-19879 #
DE83-002898	p 135	N83-21621 #	DE83-900566	p 187	N83-22788 #	DOE/ER-10807/7	p 195	N83-21527 #
DE83-002947	p 135	N83-21636 #	DE83-900567	p 82	N83-22791 #	DOE/ER-70234/T1	p 95	N83-16427 #
DE83-002953	p 179	N83-21550 #	DE83-900575	p 79	N83-21627 #			
DE83-002976	p 122	N83-20171 #	DE83-900640	p 78	N83-21618 #	DOE/ET-10069/T11	p 12	N83-17673 #
DE83-002987	p 35	N83-22782 #	DE83-900672	p 197	N83-22794 #	DOE/ET-10069/T17	p 118	N83-19862 #
DE83-003062	p 126	N83-21071 #	DE83-900732	p 131	N83-21499 #	DOE/ET-10069/T22	p 117	N83-19827 #
DE83-003085	p 182	N83-22783 #	DE83-900805	p 141	N83-22464 #	DOE/ET-10104/15	p 107	N83-17743 #

REPORT NUMBER INDEX

DE83-000820

DE82-010428	p 108	N83-18014 #	DE82-013801	p 142	N83-22466 #	DE82-021973	p 146	N83-22823 #
DE82-010442	p 97	N83-16562 #	DE82-013851	p 90	N83-23173 #	DE82-021976	p 146	N83-22824 #
DE82-010501	p 111	N83-18101 #	DE82-013875	p 176	N83-20422 #	DE82-022188	p 138	N83-22351 #
DE82-010502	p 97	N83-16561 #	DE82-013941	p 77	N83-21583 #	DE82-022210	p 55	N83-16872 #
DE82-010513	p 115	N83-19198 #	DE82-013964	p 118	N83-19853 #	DE82-022497	p 55	N83-16871 #
DE82-010518	p 106	N83-17736 #	DE82-013979	p 25	N83-20334 #	DE82-022498	p 55	N83-16873 #
DE82-010626	p 71	N83-20428 #	DE82-013981	p 81	N83-22567 #	DE82-022511	p 99	N83-16866 #
DE82-010729	p 103	N83-17651 #	DE82-013992	p 175	N83-20114 #	DE82-022512	p 99	N83-16865 #
DE82-010754	p 174	N83-19615 #	DE82-014067	p 31	N83-21201 #	DE82-022523	p 5	N83-16870 #
DE82-010789	p 95	N83-16439 #	DE82-014116	p 148	N83-23147 #	DE82-202199	p 112	N83-18327 #
DE82-010853	p 76	N83-21567 #	DE82-014121	p 148	N83-23138 #	DE82-700131	p 168	N83-18451 #
DE82-010864	p 59	N83-16927 #	DE82-014124	p 139	N83-22366 #	DE82-900748	p 106	N83-17735 #
DE82-010881	p 175	N83-20403 #	DE82-014125	p 184	N83-23146 #	DE82-901285	p 5	N83-16655 #
DE82-010913	p 32	N83-21578 #	DE82-014180	p 26	N83-20420 #	DE82-901295	p 110	N83-18052 #
DE82-010925	p 133	N83-21587 #	DE82-014253	p 24	N83-19956 #	DE82-901349	p 105	N83-17707 #
DE82-010926	p 134	N83-21596 #	DE82-014258	p 69	N83-20389 #	DE82-901395	p 15	N83-18037 #
DE82-010945	p 111	N83-18078 #	DE82-014269	p 135	N83-21661 #	DE82-901536	p 6	N83-16923 #
DE82-010948	p 19	N83-18117 #	DE82-014285	p 71	N83-20409 #	DE82-901849	p 66	N83-19330 #
DE82-010972	p 175	N83-20413 #	DE82-014306	p 140	N83-22367 #	DE82-901870	p 67	N83-20298 #
DE82-010978	p 22	N83-19328 #	DE82-014334	p 134	N83-21598 #	DE82-901905	p 77	N83-21579 #
DE82-011013	p 113	N83-18464 #	DE82-014355	p 196	N83-21580 #	DE82-901982	p 103	N83-17647 #
DE82-011019	p 107	N83-17754 #	DE82-014425	p 121	N83-19924 #	DE82-902009	p 19	N83-18116 #
DE82-011045	p 20	N83-18592 #	DE82-014457	p 138	N83-22355 #	DE82-902074	p 119	N83-19865 #
DE82-011047	p 105	N83-17678 #	DE82-014467	p 76	N83-21569 #	DE82-902135	p 97	N83-16553 #
DE82-011107	p 108	N83-18008 #	DE82-014469	p 181	N83-22484 #	DE82-902203	p 168	N83-19099 #
DE82-011217	p 19	N83-18133 #	DE82-014493	p 119	N83-19866 #	DE82-902212	p 23	N83-19334 #
DE82-011223	p 70	N83-20402 #	DE82-014494	p 196	N83-21574 #	DE82-902213	p 113	N83-18554 #
DE82-011237	p 18	N83-18108 #	DE82-014508	p 69	N83-20393 #	DE82-902297	p 10	N83-16979 #
DE82-011241	p 95	N83-16445 #	DE82-014531	p 76	N83-21568 #	DE82-902329	p 6	N83-16902 #
DE82-011278	p 122	N83-19944 #	DE82-014534	p 69	N83-20396 #	DE82-902461	p 26	N83-20378 #
DE82-011304	p 98	N83-16572 #	DE82-014598	p 127	N83-21084 #	DE82-903077	p 187	N83-20399 #
DE82-011444	p 10	N83-16977 #	DE82-014611	p 121	N83-19941 #	DE82-903079	p 187	N83-20400 #
DE82-011552	p 17	N83-18060 #	DE82-014635	p 139	N83-22358 #	DE82-903133	p 139	N83-22362 #
DE82-011559	p 95	N83-16446 #	DE82-014641	p 133	N83-21588 #	DE82-903143	p 29	N83-20744 #
DE82-011565	p 21	N83-19290 #	DE82-014647	p 76	N83-21564 #	DE82-903145	p 123	N83-20330 #
DE82-011773	p 101	N83-16928 #	DE82-014649	p 76	N83-21566 #	DE82-903307	p 198	N83-22836 #
DE82-011840	p 164	N83-16922 #	DE82-014687	p 68	N83-20388 #	DE82-903574	p 121	N83-19943 #
DE82-011848	p 138	N83-22353 #	DE82-014710	p 69	N83-20391 #	DE82-903665	p 139	N83-22361 #
DE82-011986	p 35	N83-22800 #	DE82-014711	p 76	N83-21563 #	DE82-904687	p 26	N83-20411 #
DE82-011999	p 124	N83-20406 #	DE82-014720	p 72	N83-21154 #	DE82-905090	p 26	N83-20412 #
DE82-012056	p 72	N83-21413 #	DE82-014721	p 179	N83-21571 #	DE82-905495	p 97	N83-16560 #
DE82-012058	p 81	N83-22774 #	DE82-014857	p 130	N83-21328 #	DE82-905496	p 95	N83-16444 #
DE82-012067	p 82	N83-22777 #	DE82-014984	p 77	N83-21570 #	DE82-905758	p 6	N83-16921 #
DE82-012216	p 29	N83-20842 #	DE82-015101	p 134	N83-21594 #	DE82-906065	p 101	N83-16975 #
DE82-012244	p 167	N83-18084 #	DE82-015102	p 32	N83-21593 #	DE82-906428	p 162	N83-16515 #
DE82-012310	p 71	N83-20417 #	DE82-015104	p 134	N83-21592 #	DE82-906440	p 27	N83-20433 #
DE82-012313	p 66	N83-19898 #	DE82-015114	p 134	N83-21590 #	DE82-906454	p 59	N83-16920 #
DE82-012320	p 70	N83-20407 #	DE82-015115	p 133	N83-21589 #	DE82-906459	p 193	N83-16918 #
DE82-012338	p 105	N83-17677 #	DE82-015121	p 134	N83-21595 #	DE82-906475	p 193	N83-16919 #
DE82-012369	p 104	N83-17657 #	DE82-015149	p 183	N83-22827 #	DE83-000018	p 137	N83-22350 #
DE82-012396	p 138	N83-22357 #	DE82-015220	p 70	N83-20408 #	DE83-000031	p 58	N83-16914 #
DE82-012444	p 118	N83-19862 #	DE82-015411	p 183	N83-22832 #	DE83-000032	p 58	N83-16909 #
DE82-012455	p 78	N83-21604 #	DE82-015608	p 128	N83-21136 #	DE83-000043	p 165	N83-17026 #
DE82-012472	p 72	N83-21202 #	DE82-015610	p 119	N83-19868 #	DE83-000044	p 179	N83-21549 #
DE82-012474	p 119	N83-19870 #	DE82-015611	p 119	N83-19869 #	DE83-000065	p 57	N83-16895 #
DE82-012504	p 26	N83-20405 #	DE82-015646	p 77	N83-21584 #	DE83-000067	p 57	N83-15890 #
DE82-012511	p 36	N83-22801 #	DE82-015656	p 77	N83-21585 #	DE83-000068	p 57	N83-16894 #
DE82-012520	p 81	N83-22599 #	DE82-015703	p 124	N83-20414 #	DE83-000069	p 56	N83-16889 #
DE82-012522	p 27	N83-20424 #	DE82-015908	p 176	N83-20770 #	DE83-000072	p 65	N83-19293 #
DE82-012523	p 24	N83-19957 #	DE82-016128	p 180	N83-21602 #	DE83-000086	p 74	N83-21530 #
DE82-012547	p 142	N83-22568 #	DE82-016178	p 27	N83-20427 #	DE83-000140	p 116	N83-19299 #
DE82-012553	p 147	N83-22826 #	DE82-016265	p 138	N83-22356 #	DE83-000147	p 65	N83-19296 #
DE82-012562	p 139	N83-22363 #	DE82-016398	p 120	N83-19877 #	DE83-000208	p 197	N83-22770 #
DE82-012568	p 123	N83-20333 #	DE82-016399	p 68	N83-20387 #	DE83-000225	p 36	N83-22828 #
DE82-012572	p 71	N83-20416 #	DE82-016647	p 70	N83-20401 #	DE83-000263	p 100	N83-16893 #
DE82-012576	p 104	N83-17670 #	DE82-016658	p 69	N83-20390 #	DE83-000267	p 198	N83-22815 #
DE82-012602	p 107	N83-17741 #	DE82-016729	p 70	N83-20397 #	DE83-000280	p 130	N83-21185 #
DE82-012605	p 82	N83-22776 #	DE82-016756	p 67	N83-19917 #	DE83-000306	p 31	N83-21543 #
DE82-012725	p 121	N83-19940 #	DE82-017032	p 120	N83-19876 #	DE83-000307	p 83	N83-22814 #
DE82-012770	p 133	N83-21586 #	DE82-017088	p 84	N83-22831 #	DE83-000345	p 110	N83-18073 #
DE82-012773	p 122	N83-19998 #	DE82-017089	p 124	N83-20418 #	DE83-000367	p 129	N83-21174 #
DE82-012822	p 65	N83-19283 #	DE82-017121	p 180	N83-21601 #	DE83-000368	p 129	N83-21175 #
DE82-012848	p 118	N83-19860 #	DE82-017125	p 198	N83-22834 #	DE83-000369	p 130	N83-21178 #
DE82-012870	p 179	N83-21599 #	DE82-017203	p 58	N83-16917 #	DE83-000370	p 130	N83-21177 #
DE82-012883	p 13	N83-17824 #	DE82-017397	p 130	N83-21496 #	DE83-000391	p 57	N83-16896 #
DE82-012887	p 70	N83-20404 #	DE82-018529	p 163	N83-16867 #	DE83-000393	p 57	N83-16897 #
DE82-012889	p 105	N83-17708 #	DE82-019289	p 192	N83-16866 #	DE83-000399	p 57	N83-16898 #
DE82-012896	p 195	N83-20376 #	DE82-019862	p 168	N83-19102 #	DE83-000445	p 5	N83-16653 #
DE82-012938	p 176	N83-20421 #	DE82-019912	p 135	N83-21628 #	DE83-000447	p 80	N83-22534 #
DE82-013190	p 142	N83-22468 #	DE82-020196	p 113	N83-18329 #	DE83-000449	p 167	N83-18071 #
DE82-013244	p 124	N83-20386 #	DE82-020198	p 113	N83-18328 #	DE83-000502	p 102	N83-17027 #
DE82-013245	p 26	N83-20419 #	DE82-020200	p 112	N83-18326 #	DE83-000504	p 60	N83-17001 #
DE82-013255	p 32	N83-21572 #	DE82-020201	p 112	N83-18325 #	DE83-000543	p 192	N83-16899 #
DE82-013287	p 142	N83-22467 #	DE82-020630	p 58	N83-16916 #	DE83-000568	p 90	N83-22813 #
DE82-013309	p 28	N83-20451 #	DE82-020807	p 195	N83-20432 #	DE83-000580	p 147	N83-22825 #
DE82-013319	p 24	N83-19950 #	DE82-020901	p 27	N83-20431 #	DE83-000651	p 178	N83-21548 #
DE82-013389	p 77	N83-21603 #	DE82-020993	p 75	N83-21555 #	DE83-000764	p 123	N83-20337 #
DE82-013390	p 127	N83-21083 #	DE82-020998	p 73	N83-16900 #	DE83-000772	p 129	N83-21173 #
DE82-013393	p 69	N83-20392 #	DE82-021004	p 57	N83-21521 #	DE83-000773	p 133	N83-21534 #
DE82-013414	p 138	N83-22354 #	DE82-021063	p 164	N83-16915 #	DE83-000774	p 133	N83-21535 #
DE82-013419	p 71	N83-20410 #	DE82-021088	p 136	N83-21702 #	DE83-000775	p 132	N83-21533 #
DE82-013425	p 71	N83-20426 #	DE82-021124	p 96	N83-16550 #	DE83-000776	p 132	N83-21532 #
DE82-013443	p 28	N83-20456 #	DE82-021183	p 36	N83-22816 #	DE83-000777	p 132	N83-21531 #
DE82-013508	p 121	N83-19939 #	DE82-021243	p 68	N83-20382 #	DE83-000797	p 75	N83-21556 #
DE82-013762	p 133	N83-21581 #	DE82-021288	p 100	N83-16874 #	DE83-000801	p 84	N83-22830 #
DE82-013773	p 29	N83-20457 #	DE82-021713	p 95	N83-16427 #	DE83-000820	p 34	N83-21651 #

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